SIEMENS

To: Intermountain Power Service Corporation
Delta, UT

Attn: John Christensen

December 17, 2001

Subject: Simovert S Load Commutated Inverter Drives for ID Fans
Siemens E&A, Inc., Proposal # pwlmv02054

Siemens Energy & Automation, Inc. is pleased to present you with our budgetary quotation and technical proposal for LCI drive systems. Please see our enclosures consisting of Scope of Supply, Terms and Conditions, and Technical Descriptions.

We trust that our technical proposal and prices are of interest and will meet your requirements. If you have questions or require further information please feel free to contact Wolfgang Hilmer at telephone (770) 740-3650.

Sincerely yours,

Noel D'Sa
Business Unit Manager
Large Drives Business Unit

Beth Wells
Business Unit Controller
Large Drives Business Unit

Attachments: Standard Terms and Conditions of Sale
Software License Schedule to Siemens Energy & Automation, Inc.
General Provisions For Field Service, Form No. FSO-5000-1

100 Technology Drives Tel: (770) 740-3000
Alpharetta, GA 30005 Fax: (770) 740-3050

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SCOPE OF SUPPLY SUMMARY

Item	Description
1	**Siemens LCI Drive - Type SIMOVERT S 12 pulse** 2x 6 = 12 pulse air-cooled, optically gated, LCI drive complete with field exciter control to replace existing LCI drives. Converter rating: continuous at 40°C ambient temperature and line voltage between 90 and 110% of nominal voltage. Metal enclosed free standing NEMA 1 cubicle design. Includes all interface control connections to motor and isolation transformer. A technical description of the Simovert S drive is attached to this quotation.
2	**Testing** Routine production test of frequency converter.
3	**Miscellaneous** Complete set of documentation including operations manuals, troubleshooting manuals, maintenance manuals and drawings.
4	**Warranty** Standard Terms and conditions.

NOT INCLUDED IN OUR SCOPE OF SUPPLY ARE THE FOLLOWING:

1. **Cooling/heating System (If required to maintain 0 to 40°C ambient in presence of VFD heat loss or guarantee air quality.)**
2. **Cabling (power and control)**
3. **Training**
4. **Installation & Construction Services**
5. **Start Up & Commissioning**
6. **7,500 HP synchronous motors (existing)**
7. **Drive Isolation Transformers (existing)**

COMMERCIAL CONDITIONS:

1. **Price Basis**
The prices are based upon our interpretation of your inquiry, subject to final clarification and mutual agreement upon the scope of supply. Further the unit prices are based upon total order quantity and are subject to revision for change in quantity. The prices are U.S. $ for shipment ex works (F.O.B manufacturing facility), unpacked, no freight allowed.

2. **Validity**
This quotation is budgetary only. An order would be subject to Siemens credit approval and applicable U.S. government regulations. This quotation is also subject to the customer obtaining any licenses or approvals, which may be required by the appropriate authorities.

3. **Payment Conditions**
Our prices are based upon the following payment terms:

15% of the Contract price, to be paid upon receipt of order.

75% of the Contract price upon pro rata shipment, or upon notification of readiness for shipment should shipment be delayed for reasons not attributable to Seller.

10% of the Contract price, to be paid upon completion of start-up and commissioning, but not later than 60 days after Shipment.

All payments are due 30 days after date of invoice. If necessary, it is assumed that payment guarantees or securities acceptable to Siemens will be provided. The Purchaser shall bear all associated costs for such guarantees or securities.

4. **Shipment Period**
Shipment will be approximately 12 months after receipt of a technically and commercially clarified order for the 1st set, additional sets in intervals of 3 months. Additional detailed technical clarification is to occur no later than two months after receipt of order. The exact shipment date will be confirmed after receipt of the order.

5. **Taxes**
All applicable sales, use, excise, value-added, or similar taxes are excluded and will be added to the price and invoiced separately unless an acceptable exemption certificate is furnished.

6. **Other Conditions**
For all other commercial terms and conditions, the following attached Terms and Conditions shall apply:

"Standard Terms and Conditions of Sale"

"Software License Schedule to Siemens Energy & Automation, Inc."

"General Provisions For Field Service, Form No. FSO-5000-1"

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7. Price schedule

	Description	Qty.	Unit Price	Total Price
1	Simovert S air-cooled LCI drives, 12-pulse for variable torque application, as per attached scope of supply.	8	$575,000.00 Each	$4,600,000.00
2	Adder for commissioning, field acceptance test and on-site training (estimate)	8	$15,000.00 Each	$120,000.00

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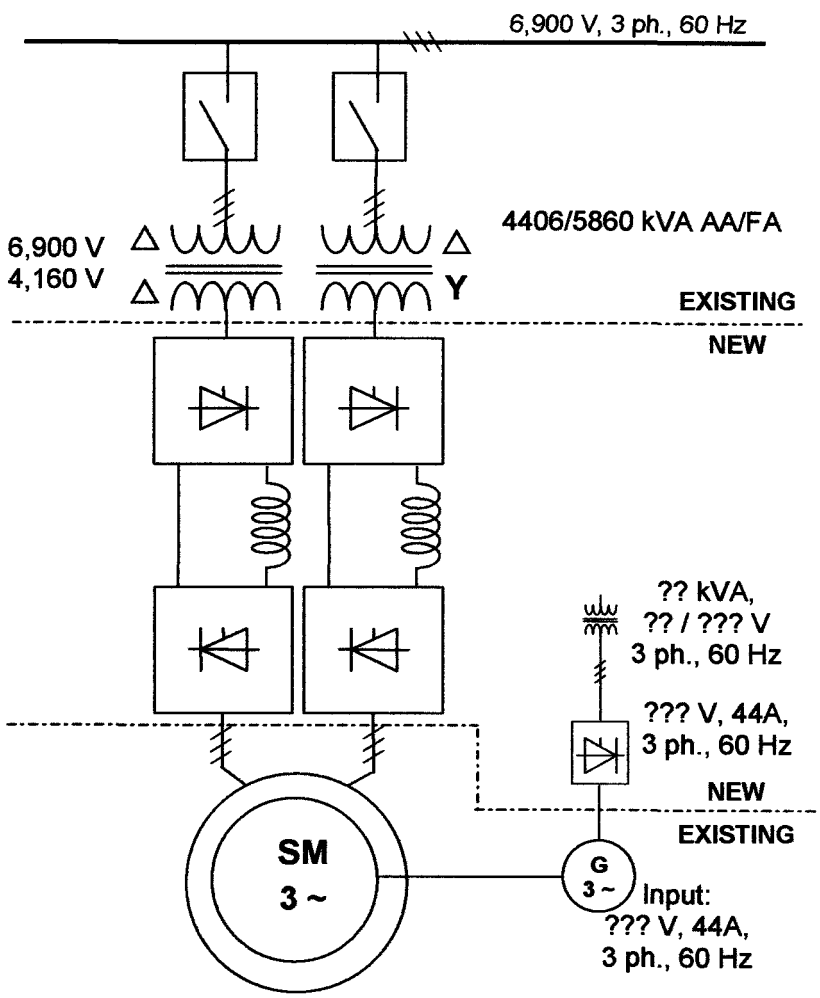
Scope of Supply

1. Overview

The new Simovert S LCI drives are to replace existing LCI drives, while retaining the existing motors, drive isolation transformers and switchgear.

Intermountain Power Project – LCI Drives



6 ph.: 7,415 HP, 954 rpm, 63.6 Hz, 2x 3,876 V, 2x 472A
3 ph.: 4,596 HP, 809 rpm, 53.93 Hz, 1x 3,876 V, 1x 538A

The new LCI drives for each motor will comprise two 6-pulse circuits each with:

- An input rectifier
- DC link reactor
- Output inverter
- Field excitation controller to control the existing rotary exciter
- Drive regulator
- Interface PLC

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2. Digital Regulator and Interface PLC

The drive regulator will be our standard fully digital control unit including speed and torque control systems, with a fiber-optic interface for firing the power SCRs. The regulator is provided with an operator panel to monitor and locally control the drive, and to change parameters.
In addition, we will provide a small PLC as an interface between our drive and the existing plant. This will allow existing control signals and interlocks that may be incorporated in the existing drive system, but not a standard feature of the new system, to be configured to best suit the plant.

3. Interface Engineering

Included in our Scope of Supply is a site visit (approx. 5 days) by one of our engineers, during the design stage of the project, to clarify the interface between the existing equipment and the new plant. This will include working through the drawings together with your staff to identify signals and to clarify the logic associated with them, and to then create an interface table listing all the input and output signals, their source/ destination, and the actions to be taken dependent on their status.

4. Power circuit

The drive comprises the following:

- Rectifier and inverter have SCRs in air-cooled, tensioned stacks, allowing easy and quick exchange of devices.
- Fuseless design
- DC link reactor as part of line-up
- Overvoltage limiters phase to phase
- Three LEM current transducers per system
- Differential pressure (air flow) monitoring
- Ground fault detection
- Pre-manufactured cables between regulator/control and power section
- Set of tools

Excluded from our offer are the following, which we will be pleased to offer if required:

- Toroidal cores to limit di/dt (see comment below)
- Test at full current.
- Witnessed testing

Cable capacitance:
If the cable capacitance exceeds the following values, it will be necessary to fit toroidal cores to limit the inrush di/dt:

Supply side: 40 nF
Motor side: 80 nF

5. Emergency Operation/redundancy

Although it is possible to offer 6-pulse emergency operation with one of the two drives per motor, this is not included in this budget offer and not recommended for a variety of reasons:

- Increased harmonics under 6-pulse operation could cause problems with other loads.
- Extremely high reliability of the drive, especially the power circuit components, makes the need for emergency operation very unlikely.
- Emergency operation with automatic change-over requires additional components – this in itself increases complexity and reduces system reliability.

- In the unlikely event of an SCR failure, replacing an SCR can be achieved in a matter of minutes. Failure of other system components (regulator/control) can cause both drives to be inoperable, so even the provision of emergency 6-pulse operation will not necessarily improve system availability.
- 6-pulse operation with only 1 drive requires the drive rating to be increased.
- The DC link reactors offered are a close-coupled pair. Siemens has patented a design that significantly reduces the flux density in the core, allowing smaller and lighter reactors to be included in the line-up. Operation with only one of the two systems would require much larger and heavier reactors that may need to be mounted separately.

6. Technical Data

Existing Synchronous Motors

Rated power	7,415 HP (5.53 MW)
Rated voltage	2x 3876 V
Impedance (Relative short circuit Voltage)	x_K = 8% (assumed)
Machine efficiency	97% (assumed)
Power factor	0.92 (assumed)
Rated speed	954 rpm
Overload	None

Existing Drive Isolation Transformers

No load voltage	4,160 V ± 10%
Rated frequency	60 Hz
Impedance (Relative short circuit Voltage)	6.1 %
Min. required rating calculated	2x 3.6 MVA
Vector group	Delta/delta and Delta/wye

Calculated Drive values for normal operation

DC link power required	2x 2.88 MW
Voltage safety factor line/motor side	2.47 / 2.66
Max. continuous DC current	2x 611 A
Overload	None
Assumed drive efficiency	99%

A) Line side

Rated input voltage:	2x 4,160 V, 3 ph. AC
Input current	2x 499 A

B) DC link

DC link voltage:	2x 4.71 kV
DC link current	2x 499 A
DC link power	2x 2.88 MW
DC link inductance (per system)	approx. 17 mH at rated current

C) Motor side

Motor voltage:	2x 3,876 V, 3 ph. AC

Motor current (fundamental)	2x 477 A
Frequency range approx	0 to 63.6 Hz

D) Drive losses

Losses to environment	approx. 55 kW

Exact losses will be calculated on request only

Assumed short circuit current (2 pole)	<18.9 kA
SCR type	T1081N70T or equivalent

Environment

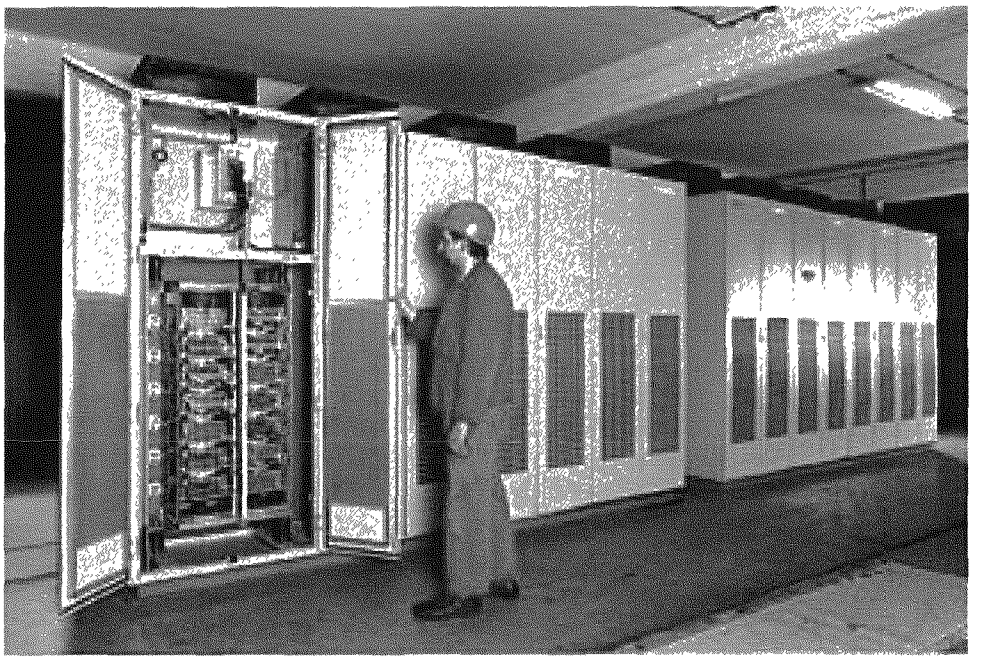
Operating temp. range	32 F to 104 F (0°to +40°C)
Altitude	<3,300 ft (1,000 m) above sea level
Relative humidity	up to 90%, non condensing

Masses and Dimensions

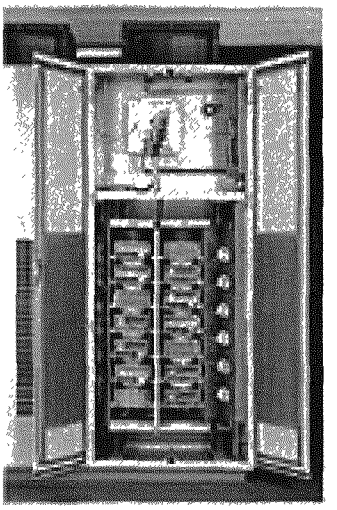
	W x D x H*
Inverter/rectifier 1	96" x 48" x 86" (2400 x 1200 x 2200 mm)
DC link reactors	48" x 48" x 86" (2400 x 1200 x 2200 mm)
Inverter/rectifier 2	96" x 48" x 86" (2400 x 1200 x 2200 mm)
Regulator, control & excitation	48" x 48" x 86" (2400 x 1200 x 2200 mm)

Total width 12 cubicles @ 24"	288" x 48" x 86" (7200 x 1200 x 2200 mm)
Total weight (incl. DC link reactors)	approx. 11,500 lb (5200 kg)
Cubicle type	NEMA1 (IP20)

(* height excludes transport beams and fans – add approx. 10" for these)



Cubicles with air-cooled SCR stacks



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SOFTWARE LICENSE / WARRANTY ADDENDUM - SIEMENS ENERGY & AUTOMATION, INC. ("SELLER") STANDARD TERMS & CONDITIONS OF SALE (1/1/2000)

This Article 1 Addendum replaces Article 1 ("Warranty") of Seller's Standard Terms and Conditions of Sale, and applies to software furnished by Seller. All other Articles contained in Seller's Standard Terms and Conditions of Sale are incorporated herein by reference.

1. **Software License, Warranty, Fees.** (a) Seller hereby grants to Buyer: a non-exclusive, non-transferable right to use the computer software program licensed under this Contract in machine-readable, object code form and any modifications made by Seller thereto ("Software"), but only in connection with the configuration of the goods and operating system for which the Software is ordered and for the end-use purpose stated in the related Seller operating documentation. Buyer agrees that neither it nor any third party shall modify, reverse engineer, decompile or reproduce the Software, without Seller's prior written consent, except for making a single copy for backup or archival purposes in accordance with the related Seller operating documentation, and provided that Seller's confidential and proprietary legend is included. Except to the extent that the parties otherwise agree in writing, Buyer's license to use the copy of such Software shall terminate upon breach of this license or the Contract by Buyer, including, without limitation, breach of payment or confidentiality obligations. All copies of the Software are the property of Seller, and all copies for which the license is terminated shall be returned to Seller promptly after termination.

(b) Seller may authorize Buyer (such as a Seller distributor or original equipment manufacturer) to transfer this software license and warranty to a third party ("Seller-authorized transferee"). Such authorization to transfer shall be in writing and signed by a Seller authorized representative. Seller-authorized transferee shall have the same rights and obligations as Buyer, except it shall not have the right to transfer such license.

(c) Seller warrants that on the date of shipment of the Software only to Buyer or Buyer's Seller-authorized transferee hereunder that: (1) the Software media contain a true and correct copy of the Software and are free from material defects; (2) Seller has the right to grant the license hereunder; and (3) the Software will function substantially in accordance with the related Seller operating documentation. Seller disclaims any warranty that the operation of the Software will be uninterrupted or error free. This warranty does not apply to software delivered by Seller but produced by others. The warranty for software produced by others shall be the warranty as stated by the software producer.

(d) If within one (1) year from date of initial installation (but not more than eighteen (18) months from date of shipment by Seller to Buyer) of Software, Buyer or its Seller-authorized transferee hereunder discovers that the Software is not as warranted above and promptly notifies Seller in writing, within this period of time, of the nonconformity, and if Seller cannot correct the nonconformity or deems correction to be commercially impracticable or prohibitively expensive, Buyer's and Buyer's Seller-authorized transferee's exclusive remedies, at Seller's option and expense, are: (1) replacement of the nonconforming Software; or (2) termination of this license and a refund of an equitable, pro rata share of the Contract price or license fee paid.

(e) This warranty will apply for the period specified in (d) above, provided that: (1) the Software is not modified, changed, or altered by anyone other than Seller or its suppliers, unless authorized by Seller in writing; (2) there is no change by anyone other than Seller to the goods for which the Software is ordered; (3) the goods are in good operating order and are installed in a suitable operating environment; (4) the nonconformity is not caused by Buyer, Buyer's Seller-authorized transferee, or any of their agents, servants, employees, or contractors, or any third party; (5) Buyer or Buyer's Seller-authorized transferee promptly notifies Seller in writing, within the period of time set forth in (d) above, of the nonconformity after it is discovered; and (6) all fees for the Software due to Seller have been paid. SELLER HEREBY DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, WITH REGARD TO THE SOFTWARE, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, COURSE OF DEALING AND USAGE OF TRADE.

(f) Buyer and successors of Buyer are limited to the remedies specified in this Article 1 and shall have no others for a nonconformity in the Software. Buyer agrees that these remedies provide Buyer and its successors with a minimum adequate remedy and are their exclusive remedies, whether Buyer's or successors' remedies are based on contract, warranty, tort (including negligence), strict liability, indemnity, or any other legal theory, and whether arising out of warranties, representations, instructions, operating documentation, installations, or non-conformities from any cause.

(g) Unless otherwise provided in this Contract, the fees for this Software license are included in the purchase price of the goods. Any subsequent modifications or enhancements to the Software made by Seller are, at Seller's option, subject to a fee.

Siemens Energy & Automation, Inc. ("Seller")

Standard Terms and Conditions of Sale (9/1/2001)

1. **WARRANTY** - (a) Seller warrants that on the date of shipment the goods are of the kind and quality described herein and are free of non-conformities in workmanship and material. This warranty does not apply to goods delivered by Seller but manufactured by others.

(b) Buyer's exclusive remedy for a nonconformity in any item of the goods shall be the repair or the replacement (at Seller's option) of the item and any affected part of the goods. Seller's obligation to repair or replace shall be in effect for a period of one (1) year from initial operation of the goods but not more than eighteen (18) months from Seller's shipment of the goods, provided Buyer has sent written notice within that period of time to Seller that the goods do not conform to the above warranty. Repaired and replacement parts shall be warranted for the remainder of the original period of notification set forth above, but in no event less than 12 months from repair or replacement. At its expense, Buyer shall remove and ship to Seller any such nonconforming items and shall reinstall the repaired or replaced parts. Buyer shall grant Seller access to the goods at all reasonable times in order for Seller to determine any nonconformity in the goods. Seller shall have the right of disposal of items replaced by it. If Seller is unable or unwilling to repair or replace, or if repair or replacement does not remedy the nonconformity, Seller and Buyer shall negotiate an equitable adjustment in the contract price, which may include a full refund of the contract price for the nonconforming goods.

(c) SELLER HEREBY DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, EXCEPT THAT OF TITLE. SPECIFICALLY, IT DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, COURSE OF DEALING AND USAGE OF TRADE.

(d) Buyer and successors of Buyer are limited to the remedies specified in this article and shall have no others for a nonconformity in the goods. Buyer agrees that these remedies provide Buyer and its successors with a minimum adequate remedy and are their exclusive remedies, whether Buyer's or its successors' remedies are based on contract, warranty, tort (including negligence), strict liability, indemnity, or any other legal theory, and whether arising out of warranties, representations, instructions, installations, or non-conformities from any cause.

(e) Note: This article 1 does not apply to any software which may be furnished by Seller. In such cases, the attached Software License Addendum applies.

2. **PATENTS** - Seller shall pay costs and damages finally awarded in any suit against Buyer or its vendees to the extent based upon a finding that the design or construction of the goods as furnished infringes a United States patent (except infringement occurring as a result of incorporating a design or modification at Buyer's request), provided that Buyer promptly notifies Seller of any charge of infringement, and Seller is given the right at its expense to settle such charge and to defend or control the defense of any suit based upon such charge. Seller shall have no obligation hereunder with respect to claims, suits or proceedings, resulting from or related to, in whole or in part, (i) the use of software or software documentation, (ii) compliance with Buyer's specifications, (iii) the combination with, or modification of, the goods after delivery by Seller, or (iv) the use of the goods, or any part thereof, in the practice of a process. THIS ARTICLE SETS FORTH SELLER'S ENTIRE LIABILITY WITH RESPECT TO PATENTS.

3. **PERFORMANCE; DELAYS** - Timely performance by Seller is contingent upon Buyer's supplying to Seller, when needed, all required technical information and data, including drawing approvals, and all required commercial documentation. If Seller suffers delay in performance due to any cause beyond its reasonable control, the time of performance shall be extended a period of time equal to the period of the delay and its consequences. Seller will give to Buyer notice within a reasonable time after Seller becomes aware of any such delay.

4. **SHIPMENT, TITLE AND RISK OF LOSS** - Unless the delivery terms of this contract expressly provide for F.O.B. destination, shipping/delivery will be F.O.B. Seller's point of shipment with title to the goods and risk of loss or damage passing to Buyer at that point. Buyer will be responsible for shipment during transit and for filing any damage or loss claims directly with the carrier. Seller may make partial shipments.

5. **TAXES** - Any applicable duties or sales, use, excise, value-added or similar taxes will be added to the price and invoiced separately (unless an acceptable exemption certificate is furnished).

6. **TERMS OF PAYMENT** - (a) Unless otherwise stated, all payments shall be in United States dollars, and a pro rata payment shall become due as each shipment is made. If shipment is delayed by Buyer, date of notice of readiness for shipment shall be deemed to be date of shipment for payment purposes.

(b) On late payments, the contract price shall, without prejudice to Seller's right to immediate payment, be increased by 1 1/2% per month on the unpaid balance, but not to exceed the maximum permitted by law.

(c) If any time in Seller's judgment Buyer is unable or unwilling to meet the terms specified, Seller may require satisfactory assurance or full or partial payment as a condition to commencing or continuing manufacture or making shipment, and may, if shipment has been made, recover the goods from the carrier, pending receipt of such assurances.

7. **NONCANCELLATION** - Buyer may not cancel or terminate for convenience, or direct suspension of manufacture, except with Seller's written consent and then only upon terms that will compensate Seller for its engineering, fabrication and purchasing charges and any other costs relating to such cancellation, termination or suspension, plus a reasonable amount for profit.

8. **NUCLEAR** - Buyer represents and warrants that the goods covered by this contract shall not be used in or in connection with a nuclear facility or application. If Buyer is unable to make such representation and warranty, then Buyer agrees to indemnify and hold harmless Seller and to waive and require its insurers to waive all right of recovery against Seller for any damage, loss, destruction, injury or death resulting from a "nuclear incident", as that term is defined in the Atomic Energy Act of 1954, as amended, whether or not due to Seller's negligence.

9. **LIMITATION OF LIABILITY** - Neither Seller, nor its suppliers shall be liable, whether in contract, warranty, failure of a remedy to achieve its intended or essential purposes, tort (including negligence), strict liability, indemnity or any other legal theory, for loss of use, revenue or profit, or for costs of capital or of substitute use or performance, or for indirect, special, liquidated, incidental or consequential damages, or for any other loss or cost of a similar type, or for claims by Buyer for damages of Buyer's customers. Seller's maximum liability under this contract shall be the contract price. Buyer and Seller agree that the exclusions and limitations set forth in this article are separate and independent from any remedies which Buyer may have hereunder and shall be given full force and effect whether or not any or all such remedies shall be deemed to have failed of their essential purpose.

10. **GOVERNING LAW AND ASSIGNMENT** - The laws of the State of Georgia shall govern the validity, interpretation and enforcement of this contract, without regard to its conflicts of law principles. The application of the United Nations Convention on Contracts for the International Sale of Goods shall be excluded. Assignment may be made only with written consent of both parties; provided, however, Seller may assign to its affiliate without Buyer's consent.

11. **ATTORNEY FEES** - Buyer shall be liable to Seller for any attorney fees and costs incurred by Seller in enforcing any of its rights hereunder.

12. **DISPUTES** - Either party may give the other party written notice of any dispute arising out of or relating to this contract and not resolved in the normal course of business. The parties shall attempt in good faith to resolve such dispute promptly by negotiations between executives who have authority to settle the dispute. If the matter has not been resolved within 60 days of the notice, either party may initiate non-binding mediation of the dispute.

13. **STATUTE OF LIMITATIONS** - To the extent permitted by applicable law, any lawsuit for breach of contract, including breach of warranty, arising out of the transactions covered by this contract, must be commenced not later than twelve (12) months from the date the cause of action accrued.

14. **PRICES** - In the event of a price increase or decrease, the price of goods on order will be adjusted to reflect such increase or decrease. This does not apply to a shipment held by request of Buyer. Goods already shipped are not subject to price increase or decrease. Orders on a bid or contract basis are not subject to this article. Seller's prices include the costs of standard domestic packing only. Any deviation from this standard packing (domestic or export), including U.S. Government sealed packing, will result in extra charges. To determine such extra charges, consult Seller's sales offices. Orders of less than $400 will be charged a $25 handling fee.

15. **ADDITIONAL TERMS OF PAYMENT** - (a) Invoice payment terms are as shown on latest discount sheets as issued from time to time. Cash discounts are not applicable to notes or trade acceptances, to prepaid transportation charges when added to Seller's invoices or to discountable items if there are undisputed past due items on the account. Portions of an invoice in dispute should be deducted and the balance remitted with a detailed explanation of the deduction. Cash discounts will only be allowed on that portion of the invoice paid within the normal discount period.

(b) Freight will be allowed to any common-carrier free-delivery point within the United States, excluding Alaska and Hawaii, on shipments exceeding $1,000 net or more providing Seller selects the carrier. On shipments to Alaska and Hawaii, freight will be allowed to dockside at the listed port of debarkation nearest the destination point on shipments of $1,000 net or more. Buyer shall pay all special costs such as cartage, stevedoring and insurance. Special freight allowances are as shown on latest discount sheets as issued from time to time. Cataloged weights are estimated, not guaranteed. Seller assumes no responsibility for tariff classifications on carriers.

16. **CHANGES IN LAWS AND REGULATIONS** - Seller's prices and timely performance are based on all applicable laws, rules, regulations, orders, codes, standards or requirements of governmental authorities effective on the date of Seller's proposal. Any change to any law, rule, regulation, order, code, standard or requirement which requires any change hereunder shall entitle Seller to an equitable adjustment in the prices and any time of performance.

SIEMENS

Reference List AC Variable Speed Drives

SIMOVERT S (LCI) variable speed drives / start-up converters with synchronous motors

Automation & Drives

Total Number: 162

Total Power: 1302.5 MW

Date of Issue: 30 March 2000

No.	Year of Order	Qty	Rating [MW]	Speed Range [RPM]	Application	Driven Machine	Customer	Country (Plant Location)
1	1969	1	1.600	20 - 1000		Sodium Pump	Interatom	France
2	1972	1	2.325	0 - 3000	Start-up Converter	Gasturbine Set	TWS Stuttgart, Gaisburg	Germany
3	1972	2	2.325	0 - 3000	Start-up Converter	Gasturbine Set	VEW Emsland	Germany
4	1972	4	2.325	0 - 3000	Start-up Converter	Gasturbine Set	VEW Gersteinwerk	Germany
5	1973	1	1.070	250 - 900		Impulse Generator	Klöckner Möller	Germany
6	1973	1	2.325	0 - 3000	Start-up Converter	Gasturbine Set	Neckarwerke, KW Altbach	Germany
7	1974	1	2.325	0 - 3000	Start-up Converter	Gasturbine Set	VEW Emsland	Germany
8	1974	1	2.325	0 - 3000	Start-up Converter	Gasturbine Set	GWK Bielefeld	Germany
9	1974	1	2.325	0 - 3000	Start-up Converter	Gasturbine Set	GKW Franken, Gebersdorf	Germany
10	1975	1	2.325	0 - 3000	Start-up Converter	Gasturbine Set	PUC Energieversorgung Oberhausen	Germany
11	1975	2	2.325	0 - 3000	Start-up Converter	Gasturbine Set	Ras Abu Fontas	Bahrein
12	1976	3	2.400	40 - 1000		Primary Pump	Breeder Reactor Kalkar	Germany
13	1976	3	1.676	40 - 1000		Secondary Pump	Breeder Reactor Kalkar	Germany
14	1976	2	1.833	150 - 1500		Extruder	Werner & Pfleiderer	Germany
15	1976	1	1.460	150 - 1500		Extruder	Hoechst	Austria
16	1978	1	22.400	0 - 300	Start-up Converter	Water Pump	TVA Racoon	USA
17	1978	4	2.325	0 - 3000	Start-up Converter	Gasturbine Set	Ras Abu Fontas	Bahrein
18	1978	1	2.325	0 - 3000	Start-up Converter	Gasturbine Set	Stadtwerke Duisburg	Germany
19	1979	1	7.480	0 - 3000	Start-up Converter	Blast Furnace Fan	Arbed Belval	Belgium
20	1979	2	2.086	120 - 900		Extruder	Danubia	Austria
21	1980	4	1.758	100 - 525		Secondary Pump	EDF / Fast Breeder	France
22	1980	2	12.000	800 - 5100		Boiler Feed Pump	TGS STEAG	Germany
23	1980	1	1.000	150 - 1500		Conveyor Belt	Larco AG	Greece
24	1981	1	1.900	120 - 1250		Extruder	Mobil Chemicals	USA
25	1981	1	2.736	540 - 1450		Water Pump	Fynsvaerket	Denmark
26	1981	2	7.070	200 - 1800		Compressor	Polysar Sarnia	Canada
27	1982	1	7.235	0 - 250	Start-up Converter	Water Pump	AYEE Rio Grande	USA
28	1982	1	22.506	0 - 257	Start-up Converter	Water Pump	VEPCO Bath County	USA
29	1982	1	1.900	0 - 333	Start-up Converter	Water Pump	Stadtwerke München, Leitzach	Germany
30	1982	1	18.700	3000 - 5200		Gas Compressor	Foothills Pipeline	Canada
31	1984	1	3.700	150 - 1500		Test equipment	University Bochum	Germany
32	1985	1	2.736	540 - 1450		Water Pump	Fynsvaerket	Denmark
33	1985	1	3.440	1240 - 1575		Gas Compressor	Petrochim	Belgium
34	1986	1	18.000	4000 - 6060		Compressor	Petromont	Canada

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Reference List AC Variable Speed Drives

SIMOVERT S (LCI) variable speed drives / start-up converters with synchronous motors

Automation & Drives

Total Number: 162

Total Power: 1302.5 MW

Date of Issue: 30 March 2000

No.	Year of Order	Qty	Rating [MW]	Speed Range [RPM]	Application	Driven Machine	Customer	Country (Plant Location)
35	1986	1	18.000	800 - 5100		Compressor	Petromont	Canada
36	1986	2	3.000	740 - 1500		Furnace Blower	BEWAG Berlin	Germany
37	1986	1	15.600	800 - 5100		Boiler Feed Pump	STEAG Walsum	Germany
38	1986	1	4.600	250 - 830		Furnace Blower	Stadtwerke Bremen	Germany
39	1987	1	8.400	1275 - 1650		Surge Generator	IPP Garching	Germany
40	1988	2	7.600	600 - 5200		Boiler Feed Pump	KW München Nord	Germany
41	1988	1	19.000	0 - 125		Water Pump	RWE Herdecke	Germany
42	1989	3	19.920	3500 - 5405		Compressor	MOSSREF Synful	South Africa
43	1989	2	11.125	500 - 4750		Boiler Feed Pump	PREAG Staudinger	Germany
44	1989	1	7.000	0 - 1500	Start-up Converter	Air Compressor	MOSGAS / Linde, Mossel Bay	South Africa
45	1989	3	11.785	500 - 5050		Boiler Feed Pump	EPZ Gertruidenberg	Netherlands
46	1990	1	12.500	0 - 3600	Start-up Converter	Blast Furnace Blower	POHANG Iron & Steel Corp.	South Korea
47	1990	1	5.000	0 - 3600	Start-up Converter	Blast Furnace Blower	POHANG Iron & Steel Corp.	South Korea
48	1991	1	9.000	0 - 3000	Start-up Converter	Blast Furnace Blower	WUHAN Iron & Steel Corp.	P.R. China
49	1992	1	2.800	900 - 1200		Extruder	Bayport	USA
50	1992	1	6.000	0 - 2100	Start-up Converter	Gasturbine Set	Demcolec B.V. Buggenum	Netherlands
51	1992	2	11.125	500 - 4750		Boiler Feed Pump	PREAG KW Rostock	Germany
52	1992	2	3.600	600 - 1050		Wire Rod Mill	Walsin-Lihwa	Taiwan
53	1992	1	11.200	0 - 500	Start-up Converter	Storage Pump	Tata Hydroelectric, Bhira	India
54	1992	1	1.900	0 - 500	Start-up Converter	Storage Pump	NTE Nord Trondelag, Tevla	Norway
55	1992	2	1.400	0 - 700	Start-up Converter	Gasturbine Set	VEBA, BKW Kirchmöser	Germany
56	1992	1	9.000	0 - 1500	Start-up Converter	Blast Furnace Blower	CMIEC, Shougang	P.R. China
57	1992	3	1.500	900 - 1200		Mixer	Conti Gummi	Portugal
58	1993	2	1.000	- 1000		Filter Blower	Stahlwerk VSZ Kosice	Slowakia
59	1993	1	1.000	- 1000		Filter Blower	Stahlwerk G. Boel, La Louviere	Belgium
60	1993	1	23.300	3000 - 4305		Blast Furnace Blower	PREUSSAG Stahl	Germany
61	1993	1	38.000	2550 - 4200		Gas Compressor	NAM UGS / Norg	Netherlands
62	1993	1	38.000	2550 - 4200		Gas Compressor	NAM UGS / Grijpskerk	Netherlands
63	1994	1	12.200	2630 - 4650		Boiler Feed Pump	Neckarwerke, KW Altbach	Germany
64	1995	1	2.700	750 - 1200		Bar and Wire Rod Mill	Freithal	Germany
65	1995	1	5.500	200 - 1000		Extruder	MONTELL / Moerdijk	Belgium
66	1995	1	5.500	800 - 1250		Bar and Wire Rod Mill	Charter Steel	USA
67	1995	1	6.500	850 - 1600		Bar and Wire Rod Mill	Zhang-Jiagang	P.R. China
68	1995	1	5.500	720 - 1600		Bar and Wire Rod Mill	Dalian	P.R. China

IP7_025810

SIEMENS

Reference List AC Variable Speed Drives

SIMOVERT S (LCI) variable speed drives / start-up converters with synchronous motors

Automation & Drives

Total Number: 162

Total Power: 1302.5 MW

Date of Issue: 30 March 2000

No.	Year of Order	Qty	Rating [MW]	Speed Range [RPM]	Application	Driven Machine	Customer	Country (Plant Location)
69	1996	1	6.500	0 - 1000	Start-up Converter	Mine Winder	LIHIR	Australia
70	1996	2	7.000	- 1500		Gas Compressor	VISUND	Norway
71	1996	1	7.000	750 - 1500		Gas Compressor	Norsk Hydro NJORD	Norway
72	1996	1	18.000	0 - 150	Start-up Converter	Water Pump	WA Guangzhou	P.R. China
73	1996	1	17.000	- 1800	Start-up Converter	Blast Furnace Blower	CST	Brazil
74	1996	4	10.500	0 - 150		Propulsion	Fincantieri / P&O (Grand Princess)	Italy/GB
75	1997	4	7.200	- 3600		Gas Compressor	OMAN / Foster Wheeler	Oman
76	1997	1	23.000	0 - 6300		Gas Compressor	NAM / GLT (Tjuchen)	Netherlands
77	1997	1	7.200	0 - 1700		Wire Rod Mill	Danieli	Malaysia
78	1997	1	3.300	0 - 1500	Start-up Converter	Starter	VITORAX	Brazil
79	1997	9	6.000	0 - 120		Propulsion	A.P. Moeller	Denmark
80	1997	1	2.300	0 - 1800	Start-up Converter	Air Compressor	HANDAN Steel	P.R.China
81	1997	6	28.300	4500 - 5040		Gas Compressor	Transcanada Pipeline	Canada
82	1997	4	7.500	- 3600		Gas Compressor	OMAN	Oman
83	1998	1	7.200	150 - 1500		Extruder	BASF / ELENAC	Germany
84	1998	1	8.000	150 - 1500		Gas Compressor	Oseberg Sued	Norway
85	1998	2	6.000	0 - 120		Propulsion	A.P. Moeller	Denmark
86	1998	1	4.500	150 - 1500		Recycle Compressor	HPCL / VIZAG	India
87	1998	5	6.000	0 - 120		Propulsion	A.P. Moeller	Denmark
88	1999	1	23.000	600 - 6300		Centrifugal Compressor	NAM GLT (Bierum)	Netherlands
89	1999	2	10.000	- 3000	Helper Motor	Centrifugal Compressor	LNG TIGA	Malaysia
90	1999	1	12.000	0 - 1500	Start-up Converter	Blast furnace Blower	POSCON	Korea
91	1999	8	9.500	0 - 150		Propulsion	Fincantieri / P&O	Italy/GB
92	2000	1	2.300	- 3600		Pump	Union Miniere	Belgium
93	2000	1	6.300	0 - 1700		Wire Rod Mill	Pingxiang	P.R. China
94	2000	1	5.500	0 - 1500	Start-up Converter	Blower	Yunnan	P.R. China

IP7_025811

STARTING FREQUENCY CONVERTER & STATIC EXCITATION SYSTEMS

US Reference List

Plant Name	SFC Rating	SES Volts	SES Amps	Ship Date
Baytown Olefins	4.0 MW	780 V	1500 A	06/09/96
Florida Power & Light	1.9 MW	780 V	1500 A	08/22/97
Sacramento Power Authority	1.9 MW	780 V	1500 A	01/28/97
Kansas City Power & Light	1.9 MW	780 V	1500 A	07/21/97
McIntosh Power Station 2	1.9 MW	780 V	1500 A	09/19/97
McIntosh Power Station 3	1.9 MW	780 V	1500 A	09/19/97
Bridgeport Harbor Plant 11	4.0 MW	780 V	1500 A	04/23/98
Bridgeport Harbor Plant 10			5200 A	
St. Francis Plant Unit 1	4.0 MW	550 V	5200 A	09/29/98
Bridgeport Energy LLC 12	4.0 MW	550 V	5200 A	12/21/98
Oglethorpe SMARR 11	1.9 MW	550 V	1500 A	03/17/99
Oglethorpe SMARR 12	1.9 MW	550 V	1500 A	03/17/99
Oklahoma Chouteau	4.0 MW	550 V	1500 A	07/23/99
Oklahoma Chouteau	4.0 MW	550 V	1500 A	07/23/99
Oklahoma Chouteau Steam Exciter		550 V	1500 A	07/23/99
Oglethorpe Unit 3	1.9 MW	550 V	1500 A	09/30/99
Oglethorpe Unit 4	1.9 MW	550 V	1500 A	09/30/99
Oglethorpe Unit 5	1.9 MW	550 V	1500 A	09/30/99
Oglethorpe Unit 6	1.9 MW	550 V	1500 A	09/30/99
Indeck Pelasant Valley Unit 1	4.0 MW	550 V	1500 A	02/01/00
Indeck Pelasant Valley Unit 2	4.0 MW	550 V	1500 A	02/01/00
Manchief Coastal Unit 1	4.0 MW	550 V	1500 A	03/01/00
Manchief Coastal Unit 2	4.0 MW	550 V	1500 A	03/01/00
St.Francis II	4.0 MW	550 V	5200 A	06/23/00
Great River Unit 1	2.9 MW	780 V	1500 A	08/18/00
Great River Unit 2	2.9 MW	780 V	1500 A	08/18/00
LG&E Monroe Unit 1	2.9 MW	780 V	1500 A	08/11/00
LG&E Monroe Unit 2	2.9 MW	780 V	1500 A	08/11/00
LG&E Monroe Unit 3	2.9 MW	780 V	1500 A	08/11/00
Fulton	2.9 MW	780 V	1500 A	12/15/00
Ennis Steam Exciter		750 V	2400 A	12/08/00
Paddys Run	2.9 MW	550 V	5200 A	12/15/00
Ennis SFC	9.0 MW	750 V	4000 A	02/28/01
Hayroad 1	1.9 MW	550 V	1500 A	01/15/01
Hayroad 2	1.9 MW	550 V	1500 A	02/15/01
Hayroad 3	1.9 MW	550 V	1500 A	03/15/01
Black Dog	2.9 MW	780 V	1500 A	09/15/01

SFC = Starting Frequency Converter
SES = Static Excitation System

IP7_025812

ASIRobicon
Industrial Power Control

Michael W. Jackson
Riter Engineering Company

875 Chestnut Street
Salt Lake City, UT 84125
Phone: 801.973.9063
Fax: 801.973.8333
www.asirobicon.com

PO Box 25005
Salt Lake City, UT 84125-0005
Cell: 801.518.2108
Email: mike@ritereng.com

Representatives for ROBICON

RITER ENGINEERING COMPANY

875 SOUTH CHESTNUT ST.
P. O. BOX 25005
SALT LAKE CITY, UTAH 84125
(801) 973-9063
FAX: (801) 973-8333

August 22, 2002

Intermountain Power Service Corp.
850 West Bush Wellman Road
Delta, UT 84624-9546

Attention: Mr. Jon Christensen

Reference: Robicon Low Voltage 6 Pulse Variable Frequency Drive
With Options and 18 Clean Power

Dear Jon,

Please see attached quotation for Robicon Drives for low voltage application with options. Pricing would be good for one year from date of quotation.

Thank you for the opportunity to meet with you and explain our products and features. We have forwarded to the factory a request for detailed information and the specifics of your request.

If you have any questions or I can be of further assistance, please don't hesitate to give me a call.

Regards,

Mike Jackson
Riter Engineering Company

MJ:id

Attachment

Cc: Pamelyn Bahr

REP POWERPRICE 4.38			Start Date:	8/22/2002
PROJECT:		**Standard Pricing For 6-Pulse VFDs**	Rev . Date:	
ITEM	***QTY***	***DESCRIPTION***	***UNIT SELL***	***ITEM TOTAL***
1	1	10 HP ID-454GT	$2,107.05	$2,107.05
2	1	15 HP ID-454GT	$2,107.05	$2,107.05
3	1	20 HP ID-454GT	$2,107.05	$2,107.05
4	1	25 HP ID-454GT	$2,280.30	$2,280.30
5	1	30 HP ID-454GT	$2,622.95	$2,622.95
6	1	40 HP ID-454GT	$3,579.95	$3,579.95
7	1	50 HP ID-454GT	$4,235.55	$4,235.55
8	1	60 HP ID-454GT	$4,833.40	$4,833.40
9	1	75 HP ID-454GT	$5,669.95	$5,669.95
10	1	100 HP ID-454GT	$6,429.50	$6,429.50
11	1	125 HP ID-454GT	$7,386.50	$7,386.50
12	1	150 HP ID-454GT	$8,940.80	$8,940.80
13	1	200 HP ID-454GT	$11,118.80	$11,118.80
14	1	250 HP ID-454GT	$13,750.00	$13,750.00
15				
Units	14		SUB TOTAL:	

FOB
(●) Robicon ( ) Destination
( ) Other:

ESTIMATED FREIGHT:	
ADDITIONAL ITEMS:	
SUBTOTAL:	
FOB:	
TOTAL	

IP7_025815

REP POWERPRICE 4.38			Start Date:	8/22/2002
PROJECT:	**Standard Pricing For 6-Pulse VFDs**		Rev . Date:	
ITEM	***QTY***	***DESCRIPTION***	***UNIT SELL***	***ITEM TOTAL***
1	1	10 HP ID-454GT With Circuit Breaker Disconnect	$2,307.80	$2,307.80
2	1	15 HP ID-454GT With Circuit Breaker Disconnect	$2,307.80	$2,307.80
3	1	20 HP ID-454GT With Circuit Breaker Disconnect	$2,307.80	$2,307.80
4	1	25 HP ID-454GT With Circuit Breaker Disconnect	$2,510.75	$2,510.75
5	1	30 HP ID-454GT With Circuit Breaker Disconnect	$2,869.35	$2,869.35
6	1	40 HP ID-454GT With Circuit Breaker Disconnect	$3,826.35	$3,826.35
7	1	50 HP ID-454GT	$4,663.45	$4,663.45
8	1	60 HP ID-454GT With Circuit Breaker Disconnect	$5,261.30	$5,261.30
9	1	75 HP ID-454GT With Circuit Breaker Disconnect	$6,097.85	$6,097.85
10	1	100 HP ID-454GT With Circuit Breaker Disconnect	$7,173.65	$7,173.65
11	1	125 HP ID-454GT With Circuit Breaker Disconnect	$8,130.65	$8,130.65
12	1	150 HP ID-454GT With Circuit Breaker Disconnect	$9,684.95	$9,684.95
13	1	200 HP ID-454GT With Circuit Breaker Disconnect	$11,956.45	$11,956.45
14	1	250 HP ID-454GT With Circuit Breaker Disconnect	$14,932.50	$14,932.50
15				
Units	14		SUB TOTAL:	

FOB
(●) Robicon ( ) Destination
( ) Other:

ESTIMATED FREIGHT:	
ADDITIONAL ITEMS:	
SUBTOTAL:	
FOB:	
TOTAL	

IP7_025816

REP POWERPRICE 4.38			Start Date:	8/22/2002
PROJECT:		**Standard Pricing for 6pulse vfd w/bypass**	Rev . Date:	
ITEM	***QTY***	***DESCRIPTION***	***UNIT SELL***	***ITEM TOTAL***
1	1	10 HP ID-454GT,BYPASS	$2,699.40	$2,699.40
2	1	15 HP ID-454GT,BYPASS	$2,699.40	$2,699.40
3	1	20 HP ID-454GT,BYPASS	$2,699.40	$2,699.40
4	1	25 HP ID-454GT,BYPASS	$2,930.95	$2,930.95
5	1	30 HP ID-454GT,BYPASS	$3,335.20	$3,335.20
6	1	40 HP ID-454GT,BYPASS	$4,292.20	$4,292.20
7	1	50 HP ID-454GT,BYPASS	$5,258.00	$5,258.00
8	1	60 HP ID-454GT,BYPASS	$6,028.00	$6,028.00
9	1	75 HP ID-454GT,BYPASS	$6,980.05	$6,980.05
10	1	100 HP ID-454GT,BYPASS	$7,980.50	$7,980.50
11	1	125 HP ID-454GT,BYPASS	$9,212.50	$9,212.50
12	1	150 HP ID-454GT,BYPASS	$11,041.80	$11,041.80
13	1	200 HP ID-454GT,BYPASS	$14,670.15	$14,670.15
14	1	250 HP ID-454GT,BYPASS	$17,301.35	$17,301.35
15				
Units	14		SUB TOTAL:	

FOB
◉ Robicon ○ Destination
○ Other:

ESTIMATED FREIGHT:	
ADDITIONAL ITEMS:	
SUBTOTAL:	
FOB:	
TOTAL	

IP7_025817

REP POWERPRICE 4.38			Start Date:	8/22/2002
PROJECT:		**Standard Pricing for Clean Power**	Rev . Date:	
ITEM	***QTY***	***DESCRIPTION***	***UNIT SELL***	***ITEM TOTAL***
1	1	10 HP Not available as standard contact Rep		
2	1	15 HP Not available as standard contact Rep		
3	1	20 HP Not available as standard contact Rep		
4	1	25 HP Not available as standard contact Rep		
5	1	30 HP Not available as standard contact Rep		
6	1	40 HP Not available as standard contact Rep		
7	1	50 HP ID-454GT,Clean Power 18-pulse	$9,996.80	$9,996.80
8	1	60 HP ID-454GT,Clean Power 18-pulse	$10,439.00	$10,439.00
9	1	75 HP ID-454GT,Clean Power 18-pulse	$11,293.70	$11,293.70
10	1	100 HP ID-454GT,Clean Power 18-pulse	$12,676.40	$12,676.40
11	1	125 HP ID-454GT,Clean Power 18-pulse	$14,275.80	$14,275.80
12	1	150 HP ID-454GT,Clean Power 18-pulse	$14,939.10	$14,939.10
13	1	200 HP ID-454GT,Clean Power 18-pulse	$17,999.30	$17,999.30
14	1	250 HP ID-454GT,Clean Power 18-pulse	$24,282.50	$24,282.50
15				
Units	14		SUB TOTAL:	

FOB
◉ Robicon ○ Destination
○ Other:

ESTIMATED FREIGHT:	
ADDITIONAL ITEMS:	
SUBTOTAL:	
FOB:	
TOTAL	

IP7_025818

REP POWERPRICE 4.38			Start Date:	8/22/2002
PROJECT:			Rev . Date:	
ITEM	QTY	DESCRIPTION	UNIT SELL	ITEM TOTAL
1				
2		10 to 40 Hp Clean Power 18-pulse vfds		
3		are not standard engineered items for Robicon		
4		please contact your Riter Engingeering for details		
5				
6				
7	1	50 HP ID-454GT,Clean Power 18pulse w/ByPass	$13,196.70	$13,196.70
8	1	60 HP ID-454GT,Clean Power 18pulse w/ByPass	$13,638.90	$13,638.90
9	1	75 HP ID-454GT,Clean Power 18pulse w/ByPass	$14,493.60	$14,493.60
10	1	100 HP ID-454GT,Clean Power 18pulse w/ByPass	$15,902.70	$15,902.70
11	1	125 HP ID-454GT,Clean Power 18pulse w/ByPass	$18,002.05	$18,002.05
12	1	150 HP ID-454GT,Clean Power 18pulse w/ByPass	$19,428.75	$19,428.75
13	1	200 HP ID-454GT,Clean Power 18pulse w/ByPass	$22,947.65	$22,947.65
14	1	250 HP ID-454GT,Clean Power 18pulse w/ByPass	$29,241.85	$29,241.85
15				
Units	8		SUB TOTAL:	

FOB
(●) Robicon ( ) Destination
( ) Other:

ESTIMATED FREIGHT:	
ADDITIONAL ITEMS:	
SUBTOTAL:	
FOB:	
TOTAL	

IP7_025819

GC-1

Roger GRACE
09/21/2001 02:42 PM

To: jon-c@ipsc.com
cc: Vince TERENZIO/DCU/DRC/ICG/GECALSTHOM@GA

Subject: New Syncdrives for ID Fans

Jon,
As you requested, as an alternative to the proposal for upgrading the controls on these fan drives, we could also offer new LCI drives from our Syncdrive product range. These would be water cooled, with a closed circuit de-ionised water and water/air heat exchanger. This would significantly lower the heat loading on the electrical room where the Varichron drives are currently located. The heat exchanger could be located outside at a convenient location.

These are dual (independent) channel drives for the 6 phase, 4kV motors in a 12/12 configuration similar to what you have at present. Each channel would have a Sigma controllers for complete redundancy. This is the same controller proposed for the controls upgrade path. At this HP rating, and to achieve the 4kV rating, this means that this is in effect a 15,000HP drive and is thus well suited to the possibility of future fan upgrades (e.g. SCR emission controls). The current dependant components; dc reactors and input transformers would have to increased accordingly. Similarly the Syncdrive single channel rating would be around 7,500HP.

Total price (accurate budget) for Qty 4 Syncdrive LCI drive systems as described above would be $1,880,000.
This includes for the water to air heat exchanger, but assumes that the existing 12 pulse cast coil transformers and iron cored dc chokes would be used. Please advise if you want to consider replacing them as well.

This LCI drive would be manufactured at our Pittsburgh facility, and on a FOB basis. Pricing does not account for any site related installation supervision or start-up services.

We would also like you to consider visiting our recent installations at the Reliant Parish 8 station. This would give you an opportunity to view first hand, similar fan drives that have had the Sigma controls upgrade, and also some new water cooled LCI drives that we have also installed at this site. Please let me know if this is of interest and I will arrange for this visit.

Please free to contact if you should require any further information whatsoever.

Roger Grace
Alstom Power Conversion,
General Drives,
Houston Office
281 870 1353

MEMORANDUM

INTERMOUNTAIN POWER SERVICE CORPORATION

TO: George W. Cross Page 1 of 1

FROM: Dennis K. Killian

DATE: August 19, 2002

SUBJECT: Sole Source Recommendation for Engineering Services
ID Fan Drive Replacement Project - IGS02-07

We recommend awarding the engineering services portion of the ID Fan Drive Replacement Project IGS 02-07, to Black & Veatch Corp. Please indicate your approval by signing the attached requisition.

We have requested and received statements of qualifications for available personnel from Sargent & Lundy (S&L), Spectrum + Bennion and Black & Veatch (B&V). After a thorough review of the resumes and project experience we recommend awarding this work to B&V.

VFD technologies have evolved significantly over the last decade. We recommend a thorough investigation into alternative designs that have the potential of solving more than just drive obsolescence concerns. Evaluation of possible SCR retrofit impacts as well as the potential for positively affecting our 6.9Kv bus power factor concerns will also be addressed.

This engineering work will be funded from the approved capital budget appropriated for ID Fan Drive Replacement. Contact James Nelson at ext. 6464 or Jon Christensen at ext. 6481 with comments.

JHN/JKH:jmg
Attachments

INTERMOUNTAIN POWER SERVICE CORPORATION

Date:	
Req./PA No:	181213
P.O. No:	
Vendor:	
Terms:	
FOB:	
Ship Via:	
Conf. To:	

☒ REQUISITION FOR CAPITAL EQUIPMENT

☐ PURCHASE AUTHORIZATION FOR EXPENSE ITEMS

Purpose of Materials, Supplies or Services:

Engineering alternative evaluation and design specification preparation on ID Fan Drive Replacement Project IGS02-07

Suggested Vendor: Black & Veatch
11401 Lamar Ave.
Overland Park, Kansas 66211

Account No. 1CCE-502
Work Order No. 02-53663
Project No. IGS02-07

Qty	Unit	Description Noun Adjective	Catalog #	Seller or Manufacturer	Unit Cost	Extension
1	job	Services, Engineering, Black & Veatch for			$80,000.00	$80,000.00
		evaluation of ID Fan variable speed drive				
		replacement alternative, preparation of				
		specifications and recommendations associated				
		with this project as detailed in the attached				
		engineering scope of work. Study to include				
		analysis of 6.9KV reactive power flow.				
		Terms and conditions as detailed in the forth-				
		coming Engineering Services Contract between				
		IPSC and B&V, shall apply for this work.				
		Labor hours shown in the attached document are				
		estimates only. No fixed or minimum cost is				
		implied.				
		TOTAL ESTIMATED COST				$80,000.00

Remarks: Suggest creating the purchase order as a 'to-be-advised'.

Delivery requested by [Date] 1/30/03 Originator James Nelson

WB for DKK
Dept. Mgr/Supt. Date

George W Coss 8/21/02
Station Manager Date

Operating Agent Date

IP7_025822

BLACK & VEATCH ENGINEERING SERVICES IN SUPPORT OF IPSC INDUCED DRAFT FAN DRIVES

The following information is provided in response to the August 9, 2002 phone call between Jon Christensen (IPSC), Bruce Godsey (B&V) and John Morrow (B&V) regarding B&V support to IPSC for the procurement and installation of replacement ID fan drive equipment.

1. Overview of the Project:

The following is a list of the Black & Veatch activities we anticipate for the project.

ENGINEERING ACTIVITIES ASSOCIATED WITH PROCUREMENT:

- Telephone conference call with IPSC (Jon Christianson) to thoroughly discuss the project, including work already performed by IPSC.
- Receive information regarding the project. (See the list of information listed below.)
- Develop list of qualified bidders. Agree with IPSC re: the suppliers from whom to request information (expecting to issue bid documents to those suppliers).
- Perform fan study, to determine capability of ID fans (and other draft equipment?) to perform with future possible pressure drops (SCR?).
- Survey vendors to clarify/confirm available lead times and costs, and their recommendations regarding replacement equipment (one vs two drive trains per motor, whether a motor can operate properly with 1 existing and 1 new drive, LCI vs PWM, new transformers, new motors, equipment foot print, benefits and costs of redundant equipment, cooling methods: water or air cooled, etc.)
- Develop Owner-review issue of spec. (It is assumed that IPSC will provide the commercial portions of the spec, and that B&V will prepare the technical portion of the spec.)
- B&V meet with IPSC at the site to a) review the information gathered (from IPSC and vendors), b) review the Owner-review issue of the spec, and c) review the status, schedule and cost for the overall project.
- Issue the spec to the bidders
- Review and evaluate the bids
- Work with IPSC to negotiate the contract with the successful bidder.
- Administer the contract, including kick-off meeting, shop drawing review, vendor surveillance (including shop trips as necessary for QC and witnessing tests).
- Assist vendor and IPSC with arrangements for shipping and receiving.

ENGINEERING ACTIVITIES ASSOCIATED WITH CONSTRUCTION DESIGN AND OTHER PROCUREMENT/DESIGN ITEMS:

After the preparation of the owner-review issue of the procurement spec, B&V will begin development of the engineering associated with the construction package. This will include:

- Prepare plant arrangement drawings
- HVAC
- Cooling water (if required)
- Circuit and raceway installation and termination information
- Demolition of existing equipment/raceway/cable/piping/etc.
- Determining method of egress and ingress for equipment and materials.

ENGINEERING ACTIVITIES ASSOCIATED WITH THE CONSTRUCTION SPEC/CONTRACT:

- Site visit to IPSC review the construction scope. (This is the same trip included under the procurement scope activities above.)
- Receive information regarding the project. (See item under procurement scope activities above.)
- Develop preliminary list of qualified bidders. Agree with IPSC re: the contractors to get qualifying information from.
- Develop owner-review issue of spec. (It is assumed that IPSC will provide the commercial portions of the spec, and that B&V will prepare the technical portion of the spec.)
- B&V meet with IPSC at the site to a) reach final agreement on the list of construction bidders, b) review the construction drawings to be included in the spec, c) review the owner-review issue of the construction spec, and d) review the status, schedule and cost for the overall project.
- Issue the spec to the bidders
- Review and evaluate the bids
- Work with IPSC to negotiate the contract with the successful bidder.
- Administer the construction contract.
- Assist the contractor and IPSC with arrangements for equipment receiving.
- Provide on-site engineering services to support the pre-outage and outage construction and the post-outage startup activities.

2. Project Schedule:

Outage for installation of the first drive is Spring (March?) 2003, and is understood to be a 4-week outage. The following is an initial estimated schedule for critical-path activities associated with receiving the first drive on site. (Activities note expected to be on the critical path are not listed.)

Engineering effort before procurement spec development – 3 weeks

Prepare owner-review issue of procurement spec – 2-4 weeks
Spec bid - 4 weeks
Review bids and award contract – 4 weeks
Lead times from award to delivery – 22-30 weeks (based on information from 2 vendors)

TOTAL OF ABOVE: 35 TO 45 WEEKS.

35 weeks from this Friday August 16 (allowing 2 days to initiate B&V engineering services) is April 20. It may be possible (though very aggressive) to give incentives to the vendors to reduce their delivery lead time to receive the equipment by the first of March. We would be very willing to jump through the necessary hoops with IPSC to aggressively work this task, to keep alive any possible opportunities for receiving and installing the equipment in Spring 2003.

3. Budget:
We have talked to various vendors and received budgetary quotes and lead times. Equipment budget for the ID fan drives would be $800,000 to $1,000,000 per fan ($6.4 to $8.0 million for 8 fans). (Robicon's $800k includes drives. ABB's $1M includes 9k hp pwm including drive (single) and motor. Both based on PWM.)

This amount does not include engineering, construction, or balance of plant items.

4. Manhours.
Estimated manhours for the engineering associated with the procurement of the ID fan drive equipment is shown below. This estimate does NOT include manhours for construction engineering/design or construction spec development.

- Engineering effort before procurement spec development – 200 manhours
- ID fan study - 200 manhours
- Prepare procurement spec – 140 manhours
- Respond to bidder questions during bid period (including pre-bid meeting) – 60 manhours
- Review bids and award contract – 100 manhours
- Contract administration, including shop drawing review and delivery/receipt support – 100 manhours
- TOTAL – 800 Manhours

This is 20 manweeks.

5. Information Required.
The following is an initial list of information which would be needed to perform this work. Some of the information would be required from IPSC, and some may be available

from B&V's records:

- List of external I/O to other plant systems to/from the drives
- Associated schematics for the drives, to be included in spec
- Complete motor data
- Plant arrangement drawings, indicating areas of drives and transformers
- Drawings regarding the available cooling supplies (air, water, closed cycle cooling water, etc.)
- Cooling information of HVAC systems.
- Recent electrical studies (load flow, fault current)

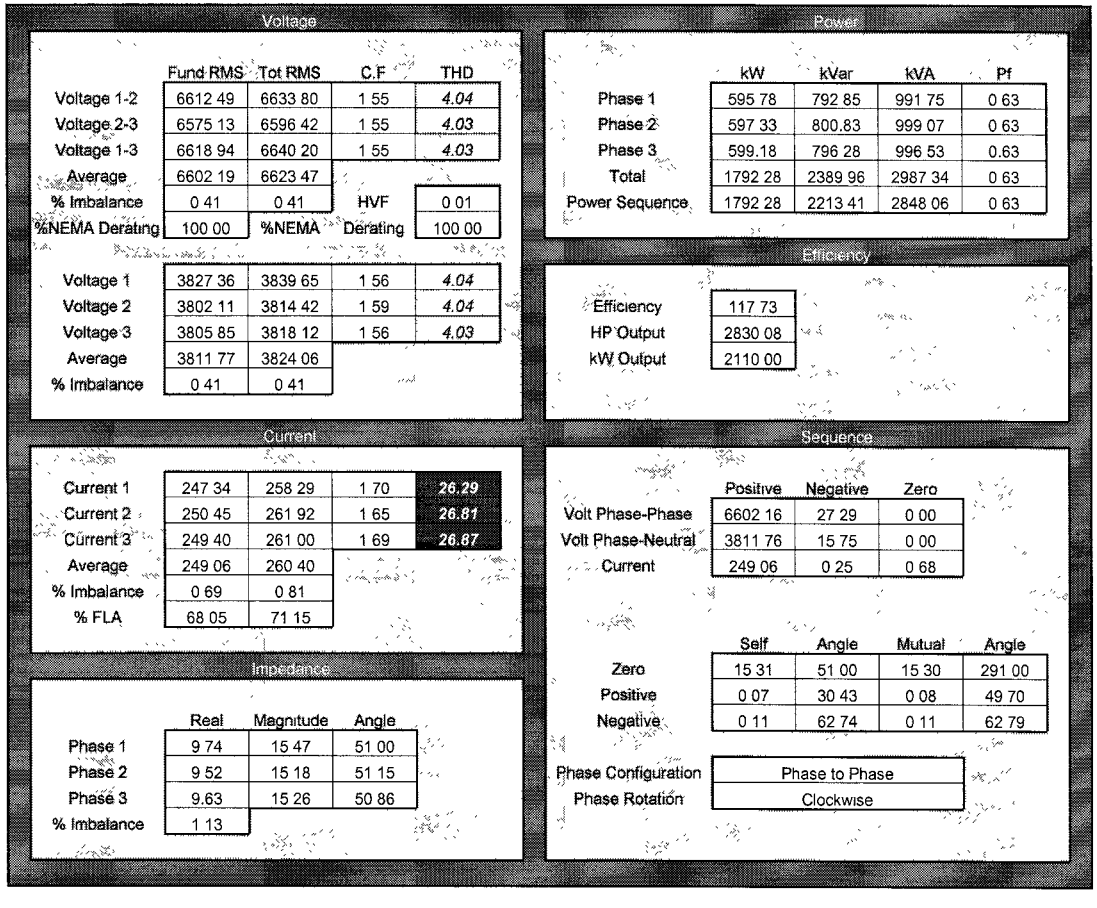
6. Conclusions.

Based on phone calls and discussions with vendor representatives, it should be possible to install the drive equipment for either a single drive or a single motor during a 4-week outage.

Preliminary information indicates that it will likely not be possible to install one new drive to operate with an existing drive, but this requires verification during design.

It would be difficult to procure the drive equipment in order to install one drive or the drive(s) for a single motor. This may, however, be possible by starting immediately and by giving incentives for expedited drawings preparation and manufacturing. Forcing delivery to accommodate a Spring 2003 outage would eliminate some vendors.

We recommend that IPSC begin the effort immediately, in order to keep alive any possibilities of installing the first drive in Spring 2003.



Voltage

	Fund RMS	Tot RMS	C.F	THD
Voltage 1-2	6612 49	6633 80	1 55	*4.04*
Voltage 2-3	6575 13	6596 42	1 55	*4.03*
Voltage 1-3	6618 94	6640 20	1 55	*4.03*
Average	6602 19	6623 47		
% Imbalance	0 41	0 41	HVF	0 01
%NEMA Derating	100 00	%NEMA Derating		100 00

Voltage 1	3827 36	3839 65	1 56	*4.04*
Voltage 2	3802 11	3814 42	1 59	*4.04*
Voltage 3	3805 85	3818 12	1 56	*4.03*
Average	3811 77	3824 06		
% Imbalance	0 41	0 41		

Power

	kW	kVar	kVA	Pf
Phase 1	595 78	792 85	991 75	0 63
Phase 2	597 33	800.83	999 07	0 63
Phase 3	599.18	796 28	996 53	0.63
Total	1792 28	2389 96	2987 34	0 63
Power Sequence	1792 28	2213 41	2848 06	0 63

Efficiency

Efficiency	117 73
HP Output	2830 08
kW Output	2110 00

Current

Current 1	247 34	258 29	1 70	**26.29**
Current 2	250 45	261 92	1 65	**26.81**
Current 3	249 40	261 00	1 69	**26.87**
Average	249 06	260 40		
% Imbalance	0 69	0 81		
% FLA	68 05	71 15		

Impedance

	Real	Magnitude	Angle
Phase 1	9 74	15 47	51 00
Phase 2	9 52	15 18	51 15
Phase 3	9.63	15 26	50 86
% Imbalance	1 13		

Sequence

	Positive	Negative	Zero
Volt Phase-Phase	6602 16	27 29	0 00
Volt Phase-Neutral	3811 76	15 75	0 00
Current	249 06	0 25	0 68

	Self	Angle	Mutual	Angle
Zero	15 31	51 00	15 30	291 00
Positive	0 07	30 43	0 08	49 70
Negative	0 11	62 74	0 11	62 79

Phase Configuration	Phase to Phase
Phase Rotation	Clockwise

UNIT 2

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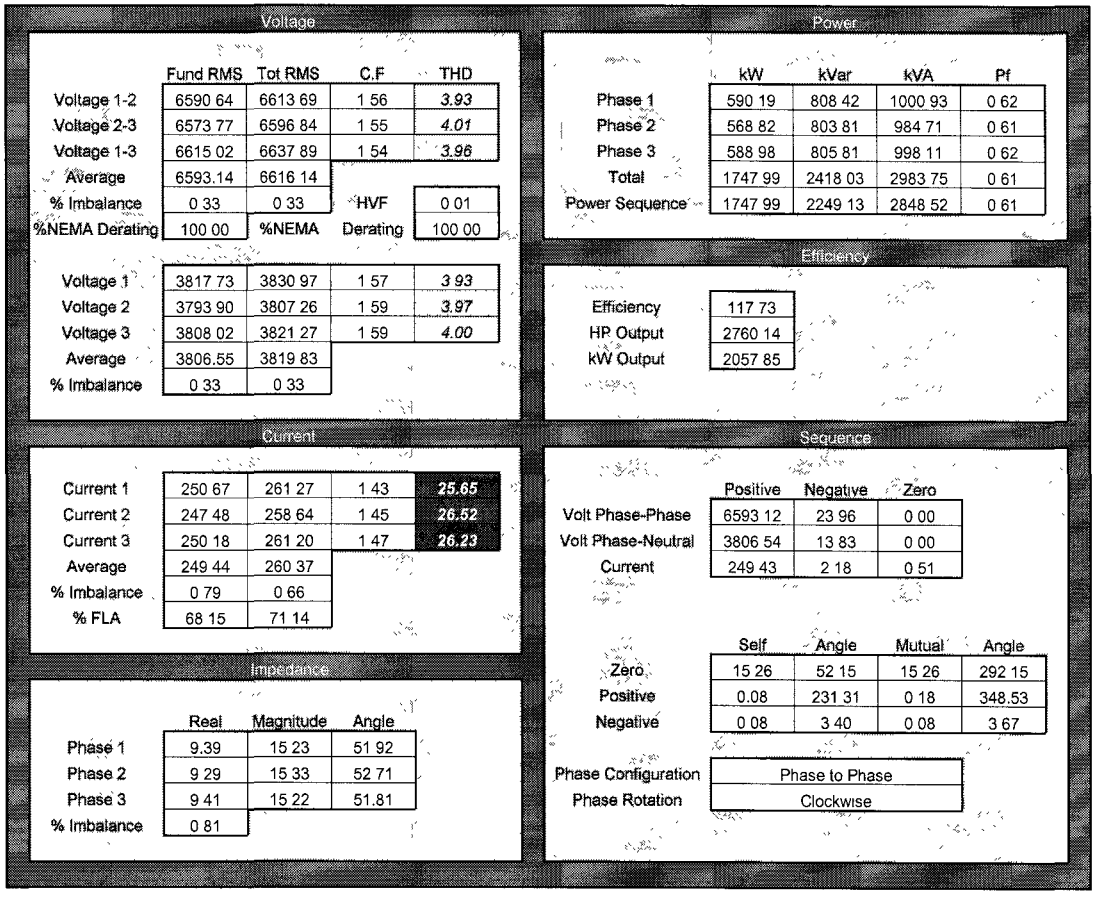

Voltage

	Fund RMS	Tot RMS	C.F	THD
Voltage 1-2	6590 64	6613 69	1 56	3.93
Voltage 2-3	6573 77	6596 84	1 55	4.01
Voltage 1-3	6615 02	6637 89	1 54	3.96
Average	6593.14	6616 14		
% Imbalance	0 33	0 33	HVF	0 01
%NEMA Derating	100 00	%NEMA	Derating	100 00

Voltage 1	3817 73	3830 97	1 57	3 93
Voltage 2	3793 90	3807 26	1 59	3.97
Voltage 3	3808 02	3821 27	1 59	4.00
Average	3806.55	3819 83		
% Imbalance	0 33	0 33		

Power

	kW	kVar	kVA	Pf
Phase 1	590 19	808 42	1000 93	0 62
Phase 2	568 82	803 81	984 71	0 61
Phase 3	588 98	805 81	998 11	0 62
Total	1747 99	2418 03	2983 75	0 61
Power Sequence	1747 99	2249 13	2848 52	0 61

Efficiency

Efficiency	117 73
HP Output	2760 14
kW Output	2057 85

Current

Current 1	250 67	261 27	1 43	25.65
Current 2	247 48	258 64	1 45	26.52
Current 3	250 18	261 20	1 47	26.23
Average	249 44	260 37		
% Imbalance	0 79	0 66		
% FLA	68 15	71 14		

Impedance

	Real	Magnitude	Angle
Phase 1	9.39	15 23	51 92
Phase 2	9 29	15 33	52 71
Phase 3	9 41	15 22	51.81
% Imbalance	0 81		

Sequence

	Positive	Negative	Zero
Volt Phase-Phase	6593 12	23 96	0 00
Volt Phase-Neutral	3806 54	13 83	0 00
Current	249 43	2 18	0 51

	Self	Angle	Mutual	Angle
Zero	15 26	52 15	15 26	292 15
Positive	0.08	231 31	0 18	348.53
Negative	0 08	3 40	0 08	3 67

Phase Configuration	Phase to Phase
Phase Rotation	Clockwise

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UNIT 2

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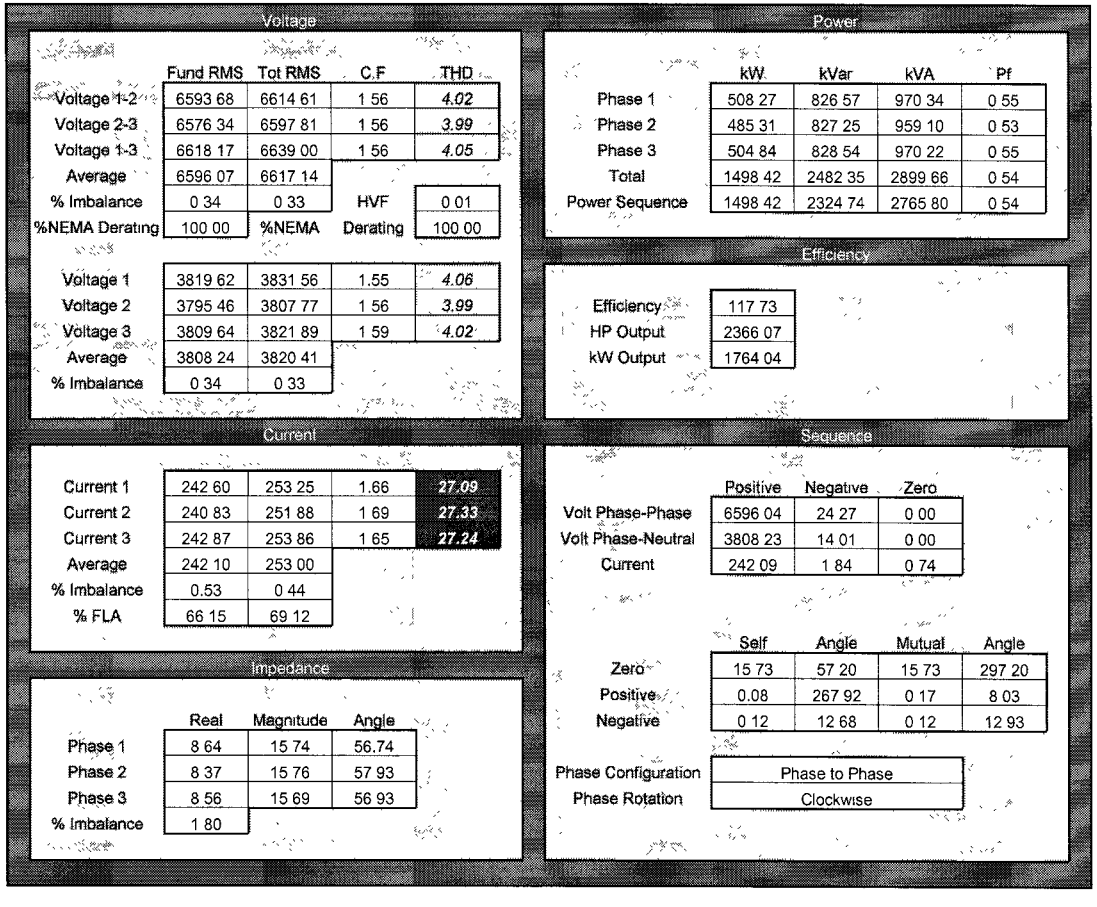

Voltage

	Fund RMS	Tot RMS	C.F	THD
Voltage 1-2	6593 68	6614 61	1 56	4.02
Voltage 2-3	6576 34	6597 81	1 56	3.99
Voltage 1-3	6618 17	6639 00	1 56	4.05
Average	6596 07	6617 14		
% Imbalance	0 34	0 33	HVF	0 01
%NEMA Derating	100 00	%NEMA	Derating	100 00

Voltage 1	3819 62	3831 56	1.55	4.06
Voltage 2	3795 46	3807 77	1 56	3.99
Voltage 3	3809 64	3821 89	1 59	4.02
Average	3808 24	3820 41		
% Imbalance	0 34	0 33		

Power

	kW	kVar	kVA	Pf
Phase 1	508 27	826 57	970 34	0 55
Phase 2	485 31	827 25	959 10	0 53
Phase 3	504 84	828 54	970 22	0 55
Total	1498 42	2482 35	2899 66	0 54
Power Sequence	1498 42	2324 74	2765 80	0 54

Efficiency

Efficiency	117 73
HP Output	2366 07
kW Output	1764 04

Current

Current 1	242 60	253 25	1.66	27.09
Current 2	240 83	251 88	1 69	27.33
Current 3	242 87	253 86	1 65	27.24
Average	242 10	253 00		
% Imbalance	0.53	0 44		
% FLA	66 15	69 12		

Impedance

	Real	Magnitude	Angle
Phase 1	8 64	15 74	56.74
Phase 2	8 37	15 76	57 93
Phase 3	8 56	15 69	56 93
% Imbalance	1 80		

Sequence

	Positive	Negative	Zero
Volt Phase-Phase	6596 04	24 27	0 00
Volt Phase-Neutral	3808 23	14 01	0 00
Current	242 09	1 84	0 74

	Self	Angle	Mutual	Angle
Zero	15 73	57 20	15 73	297 20
Positive	0.08	267 92	0 17	8 03
Negative	0 12	12 68	0 12	12 93

Phase Configuration	Phase to Phase
Phase Rotation	Clockwise

IP7_025829

UNIT 8

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Voltage

	Fund RMS	Tot RMS	C.F	THD
Voltage 1-2	6599 35	6621 61	1 55	*3.89*
Voltage 2-3	6567 94	6590 51	1 56	*3.91*
Voltage 1-3	6620 62	6642 49	1 56	*3.88*
Average	6595 97	6618 21		
% Imbalance	0 43	0 42	HVF	0 01
%NEMA Derating	100 00	%NEMA	Derating	100 00

Voltage 1	3824 34	3836 98	1 56	*3.88*
Voltage 2	3793.94	3806 99	1 59	*3.90*
Voltage 3	3806 27	3819 10	1 57	*3.90*
Average	3808 18	3821 02		
% Imbalance	0 42	0 42		

Current

Current 1	246 71	257 67	1 47	**26.49**
Current 2	247 37	258 50	1 50	**26.69**
Current 3	246 76	257 83	1 49	**26.66**
Average	246 95	258 00		
% Imbalance	0 17	0.19		
% FLA	67 47	70 49		

Impedance

	Real	Magnitude	Angle
Phase 1	8 81	15 50	55 36
Phase 2	8 57	15 34	56 04
Phase 3	8 66	15 43	55 85
% Imbalance	1 51		

Power

	kW	kVar	kVA	Pf
Phase 1	536 25	830 62	988 68	0 57
Phase 2	524 23	832 87	984 11	0 56
Phase 3	527 27	831 59	984 66	0 56
Total	1587 74	2495 08	2957 46	0 56
Power Sequence	1587.74	2332 04	2821 23	0 56

Efficiency

Efficiency	117 73
HP Output	2507 11
kW Output	1869 20

Sequence

	Positive	Negative	Zero
Volt Phase-Phase	6595 93	30 59	0 00
Volt Phase-Neutral	3808 16	17 66	0 00
Current	246 94	1 02	0.38

	Self	Angle	Mutual	Angle
Zero	15 42	55.75	15 42	295 75
Positive	0.08	343 53	0 13	38.66
Negative	0 06	29 85	0 06	30 33

Phase Configuration	Phase to Phase
Phase Rotation	Clockwise

IP7_025830

UNIT 2

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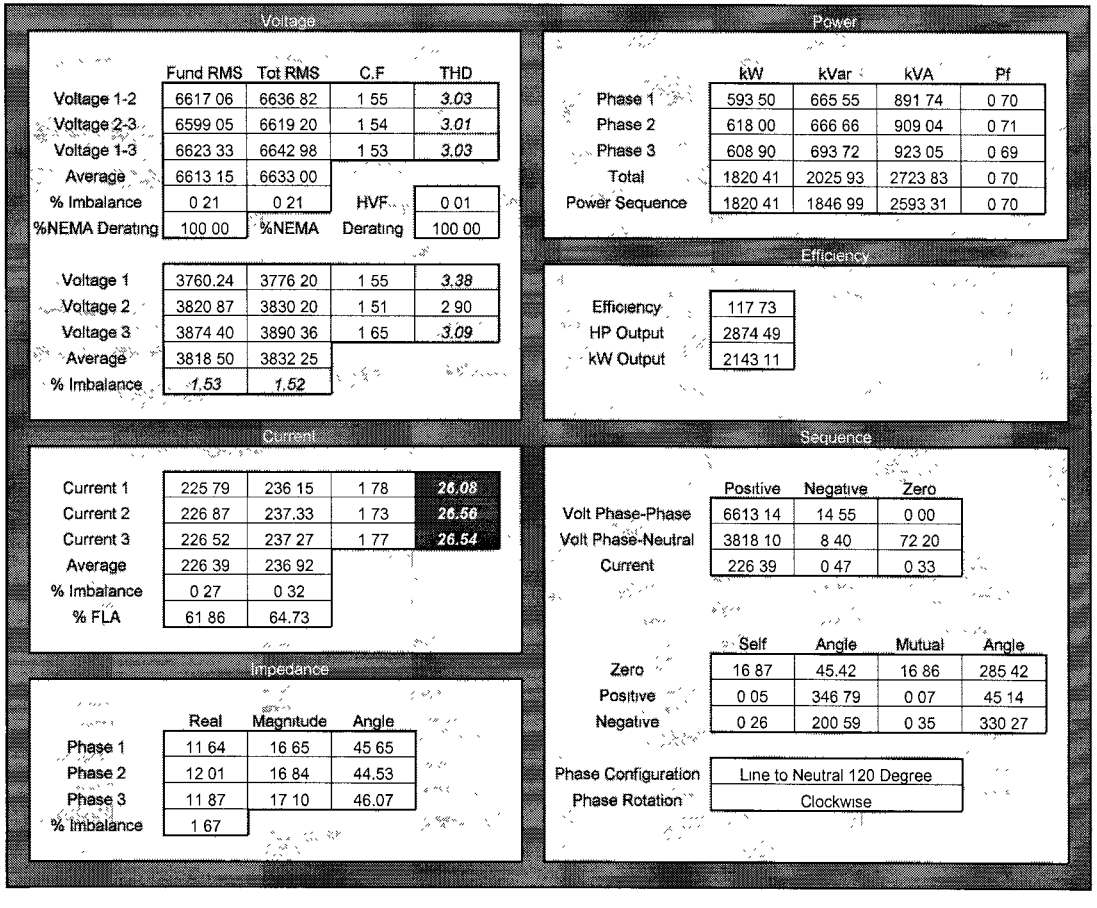

Voltage

	Fund RMS	Tot RMS	C.F	THD
Voltage 1-2	6617 06	6636 82	1 55	3.03
Voltage 2-3	6599 05	6619 20	1 54	3.01
Voltage 1-3	6623 33	6642 98	1 53	3.03
Average	6613 15	6633 00		
% Imbalance	0 21	0 21	HVF	0 01
%NEMA Derating	100 00	%NEMA	Derating	100 00

Voltage 1	3760.24	3776 20	1 55	3.38
Voltage 2	3820 87	3830 20	1 51	2 90
Voltage 3	3874 40	3890 36	1 65	3.09
Average	3818 50	3832 25		
% Imbalance	1.53	1.52		

Power

	kW	kVar	kVA	Pf
Phase 1	593 50	665 55	891 74	0 70
Phase 2	618 00	666 66	909 04	0 71
Phase 3	608 90	693 72	923 05	0 69
Total	1820 41	2025 93	2723 83	0 70
Power Sequence	1820 41	1846 99	2593 31	0 70

Efficiency

Efficiency	117 73
HP Output	2874 49
kW Output	2143 11

Current

Current 1	225 79	236 15	1 78	26.08
Current 2	226 87	237.33	1 73	26.56
Current 3	226 52	237 27	1 77	26.54
Average	226 39	236 92		
% Imbalance	0 27	0 32		
% FLA	61 86	64.73		

Impedance

	Real	Magnitude	Angle
Phase 1	11 64	16 65	45 65
Phase 2	12 01	16 84	44.53
Phase 3	11 87	17 10	46.07
% Imbalance	1 67		

Sequence

	Positive	Negative	Zero
Volt Phase-Phase	6613 14	14 55	0 00
Volt Phase-Neutral	3818 10	8 40	72 20
Current	226 39	0 47	0 33

	Self	Angle	Mutual	Angle
Zero	16 87	45.42	16 86	285 42
Positive	0 05	346 79	0 07	45 14
Negative	0 26	200 59	0 35	330 27

Phase Configuration	Line to Neutral 120 Degree
Phase Rotation	Clockwise

IP7_025831

UNIT 2

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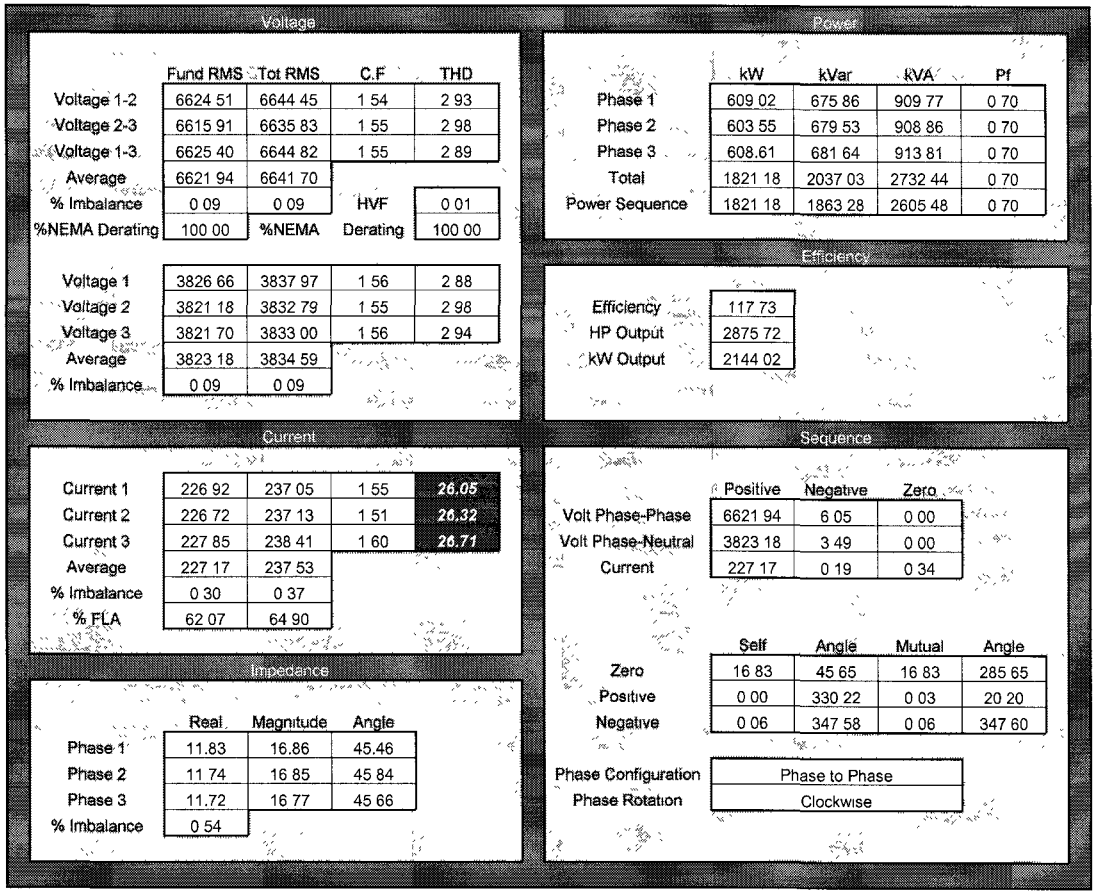

Voltage

	Fund RMS	Tot RMS	C.F	THD
Voltage 1-2	6624 51	6644 45	1 54	2 93
Voltage 2-3	6615 91	6635 83	1 55	2 98
Voltage 1-3	6625 40	6644 82	1 55	2 89
Average	6621 94	6641 70		
% Imbalance	0 09	0 09	HVF	0 01
%NEMA Derating	100 00	%NEMA	Derating	100 00

Voltage 1	3826 66	3837 97	1 56	2 88
Voltage 2	3821 18	3832 79	1 55	2 98
Voltage 3	3821 70	3833 00	1 56	2 94
Average	3823 18	3834 59		
% Imbalance	0 09	0 09		

Power

	kW	kVar	kVA	Pf
Phase 1	609 02	675 86	909 77	0 70
Phase 2	603 55	679 53	908 86	0 70
Phase 3	608.61	681 64	913 81	0 70
Total	1821 18	2037 03	2732 44	0 70
Power Sequence	1821 18	1863 28	2605 48	0 70

Efficiency

Efficiency	117 73
HP Output	2875 72
kW Output	2144 02

Current

Current 1	226 92	237 05	1 55	26.05
Current 2	226 72	237 13	1 51	26.32
Current 3	227 85	238 41	1 60	26.71
Average	227 17	237 53		
% Imbalance	0 30	0 37		
% FLA	62 07	64 90		

Sequence

	Positive	Negative	Zero
Volt Phase-Phase	6621 94	6 05	0 00
Volt Phase-Neutral	3823 18	3 49	0 00
Current	227 17	0 19	0 34

	Self	Angle	Mutual	Angle
Zero	16 83	45 65	16 83	285 65
Positive	0 00	330 22	0 03	20 20
Negative	0 06	347 58	0 06	347 60

Phase Configuration	Phase to Phase
Phase Rotation	Clockwise

Impedance

	Real	Magnitude	Angle
Phase 1	11.83	16.86	45.46
Phase 2	11 74	16 85	45 84
Phase 3	11.72	16 77	45 66
% Imbalance	0 54		

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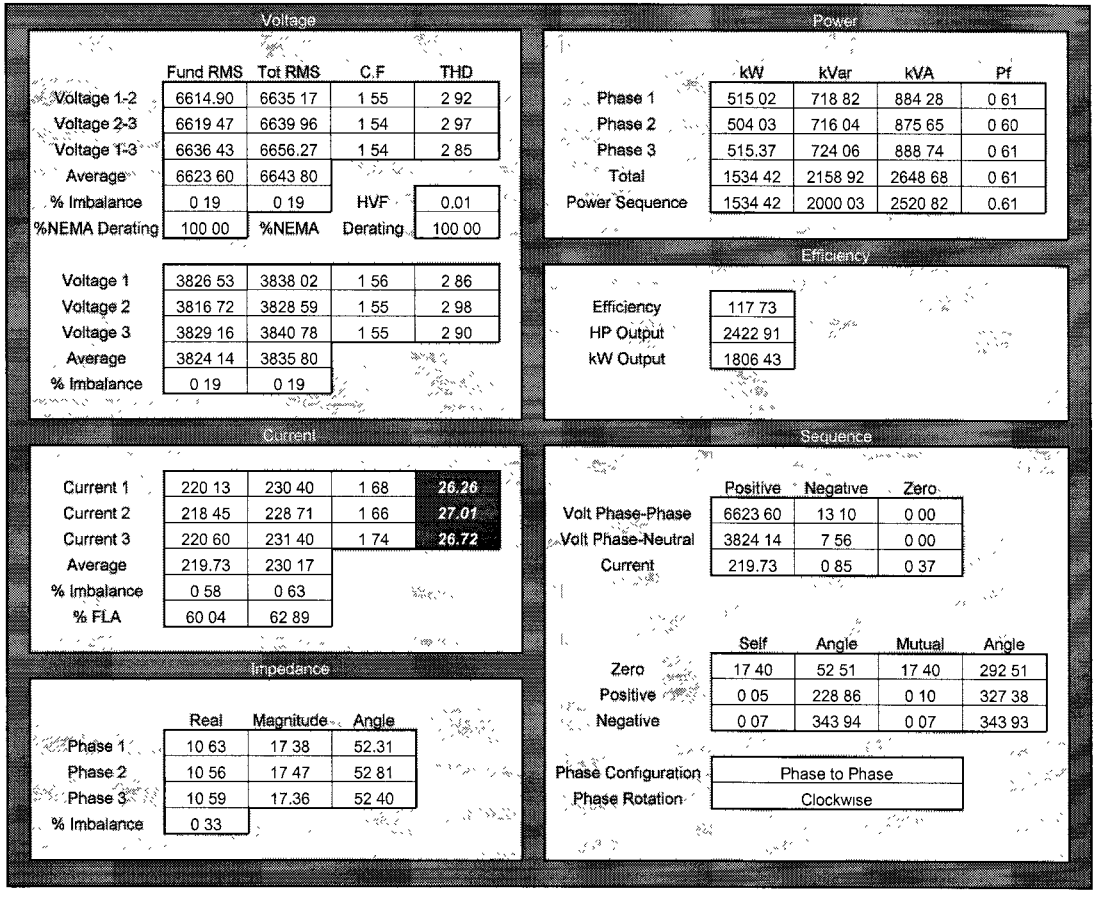


Voltage

	Fund RMS	Tot RMS	C.F	THD
Voltage 1-2	6614.90	6635 17	1 55	2 92
Voltage 2-3	6619 47	6639 96	1 54	2 97
Voltage 1-3	6636 43	6656.27	1 54	2 85
Average	6623 60	6643 80		
% Imbalance	0 19	0 19	HVF	0.01
%NEMA Derating	100 00	%NEMA	Derating	100 00

Voltage 1	3826 53	3838 02	1 56	2 86
Voltage 2	3816 72	3828 59	1 55	2 98
Voltage 3	3829 16	3840 78	1 55	2 90
Average	3824 14	3835 80		
% Imbalance	0 19	0 19		

Power

	kW	kVar	kVA	Pf
Phase 1	515 02	718 82	884 28	0 61
Phase 2	504 03	716 04	875 65	0 60
Phase 3	515.37	724 06	888 74	0 61
Total	1534 42	2158 92	2648 68	0 61
Power Sequence	1534 42	2000 03	2520 82	0.61

Efficiency

Efficiency	117 73
HP Output	2422 91
kW Output	1806 43

Current

Current 1	220 13	230 40	1 68	26.26
Current 2	218 45	228 71	1 66	27.01
Current 3	220 60	231 40	1 74	26.72
Average	219.73	230 17		
% Imbalance	0 58	0 63		
% FLA	60 04	62 89		

Impedance

	Real	Magnitude	Angle
Phase 1	10 63	17 38	52.31
Phase 2	10 56	17 47	52 81
Phase 3	10 59	17.36	52 40
% Imbalance	0 33		

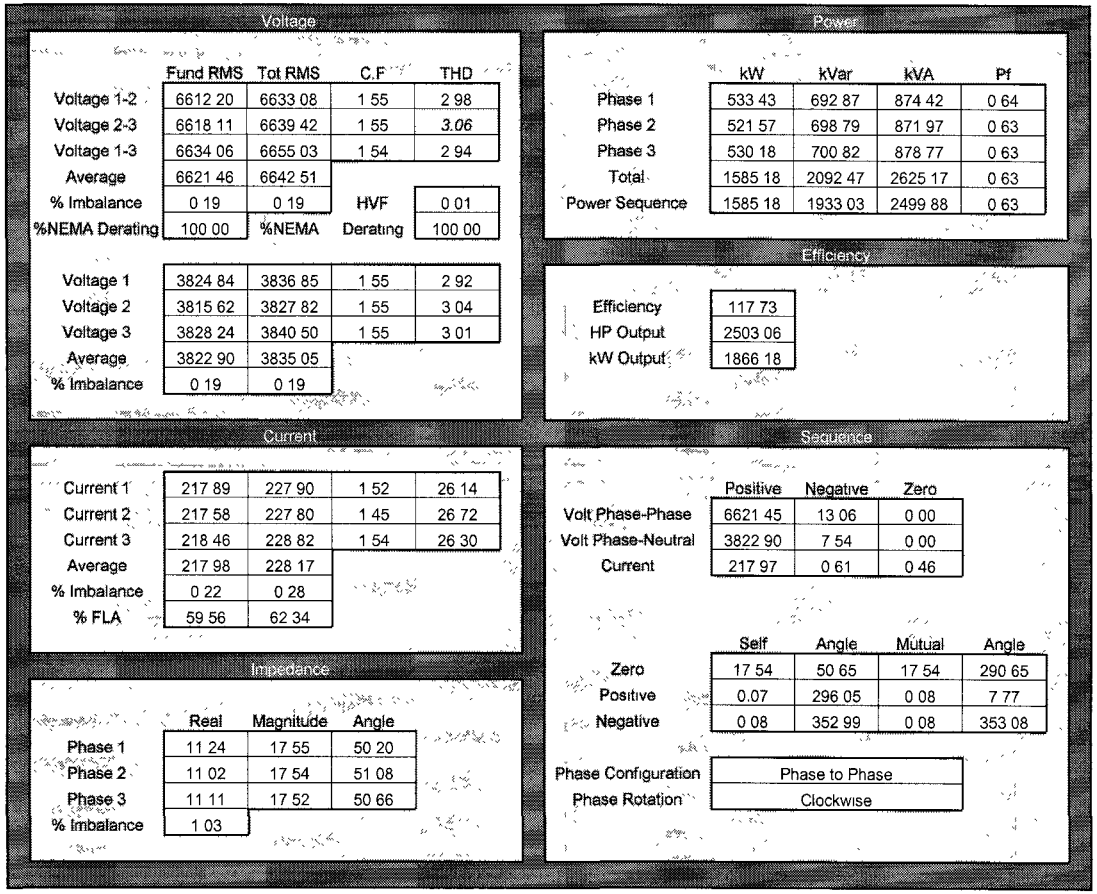
Sequence

	Positive	Negative	Zero
Volt Phase-Phase	6623 60	13 10	0 00
Volt Phase-Neutral	3824 14	7 56	0 00
Current	219.73	0 85	0 37

	Self	Angle	Mutual	Angle
Zero	17 40	52 51	17 40	292 51
Positive	0 05	228 86	0 10	327 38
Negative	0 07	343 94	0 07	343 93

Phase Configuration	Phase to Phase
Phase Rotation	Clockwise

UNIT 2



Voltage

	Fund RMS	Tot RMS	C.F	THD
Voltage 1-2	6612 20	6633 08	1 55	2 98
Voltage 2-3	6618 11	6639 42	1 55	3.06
Voltage 1-3	6634 06	6655 03	1 54	2 94
Average	6621 46	6642 51		
% Imbalance	0 19	0 19	HVF	0 01
%NEMA Derating	100 00	%NEMA	Derating	100 00

Voltage 1	3824 84	3836 85	1 55	2 92
Voltage 2	3815 62	3827 82	1 55	3 04
Voltage 3	3828 24	3840 50	1 55	3 01
Average	3822 90	3835 05		
% Imbalance	0 19	0 19		

Power

	kW	kVar	kVA	Pf
Phase 1	533 43	692 87	874 42	0 64
Phase 2	521 57	698 79	871 97	0 63
Phase 3	530 18	700 82	878 77	0 63
Total	1585 18	2092 47	2625 17	0 63
Power Sequence	1585 18	1933 03	2499 88	0 63

Efficiency

Efficiency	117 73
HP Output	2503 06
kW Output	1866 18

Current

Current 1	217 89	227 90	1 52	26 14
Current 2	217 58	227 80	1 45	26 72
Current 3	218 46	228 82	1 54	26 30
Average	217 98	228 17		
% Imbalance	0 22	0 28		
% FLA	59 56	62 34		

Impedance

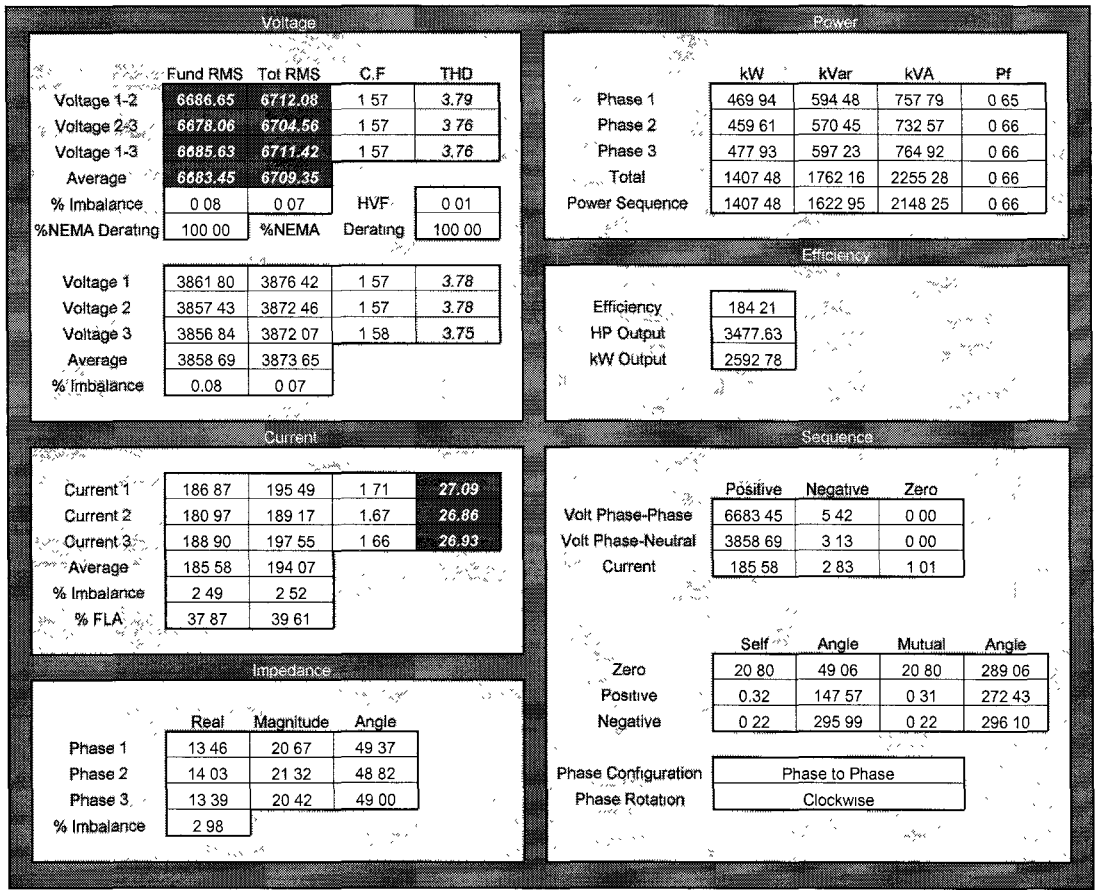
	Real	Magnitude	Angle
Phase 1	11 24	17 55	50 20
Phase 2	11 02	17 54	51 08
Phase 3	11 11	17 52	50 66
% Imbalance	1 03		

Sequence

	Positive	Negative	Zero
Volt Phase-Phase	6621 45	13 06	0 00
Volt Phase-Neutral	3822 90	7 54	0 00
Current	217 97	0 61	0 46

	Self	Angle	Mutual	Angle
Zero	17 54	50 65	17 54	290 65
Positive	0.07	296 05	0 08	7 77
Negative	0 08	352 99	0 08	353 08

Phase Configuration	Phase to Phase
Phase Rotation	Clockwise



Voltage

	Fund RMS	Tot RMS	C.F	THD
Voltage 1-2	6686.65	6712.08	1 57	3.79
Voltage 2-3	6678.06	6704.56	1 57	3 76
Voltage 1-3	6685.63	6711.42	1 57	3.76
Average	6683.45	6709.35		
% Imbalance	0 08	0 07	HVF	0 01
%NEMA Derating	100 00	%NEMA	Derating	100 00

Voltage 1	3861 80	3876 42	1 57	3.78
Voltage 2	3857 43	3872 46	1 57	3.78
Voltage 3	3856 84	3872 07	1 58	3.75
Average	3858 69	3873 65		
% Imbalance	0.08	0 07		

Power

	kW	kVar	kVA	Pf
Phase 1	469 94	594 48	757 79	0 65
Phase 2	459 61	570 45	732 57	0 66
Phase 3	477 93	597 23	764 92	0 66
Total	1407 48	1762 16	2255 28	0 66
Power Sequence	1407 48	1622 95	2148 25	0 66

Efficiency

Efficiency	184 21
HP Output	3477.63
kW Output	2592 78

Current

Current 1	186 87	195 49	1 71	27.09
Current 2	180 97	189 17	1.67	26.86
Current 3	188 90	197 55	1 66	26.93
Average	185 58	194 07		
% Imbalance	2 49	2 52		
% FLA	37 87	39 61		

Impedance

	Real	Magnitude	Angle
Phase 1	13 46	20 67	49 37
Phase 2	14 03	21 32	48 82
Phase 3	13 39	20 42	49 00
% Imbalance	2 98		

Sequence

	Positive	Negative	Zero
Volt Phase-Phase	6683 45	5 42	0 00
Volt Phase-Neutral	3858 69	3 13	0 00
Current	185 58	2 83	1 01

	Self	Angle	Mutual	Angle
Zero	20 80	49 06	20 80	289 06
Positive	0.32	147 57	0 31	272 43
Negative	0 22	295 99	0 22	296 10

Phase Configuration	Phase to Phase
Phase Rotation	Clockwise

UNIT 1 1A2

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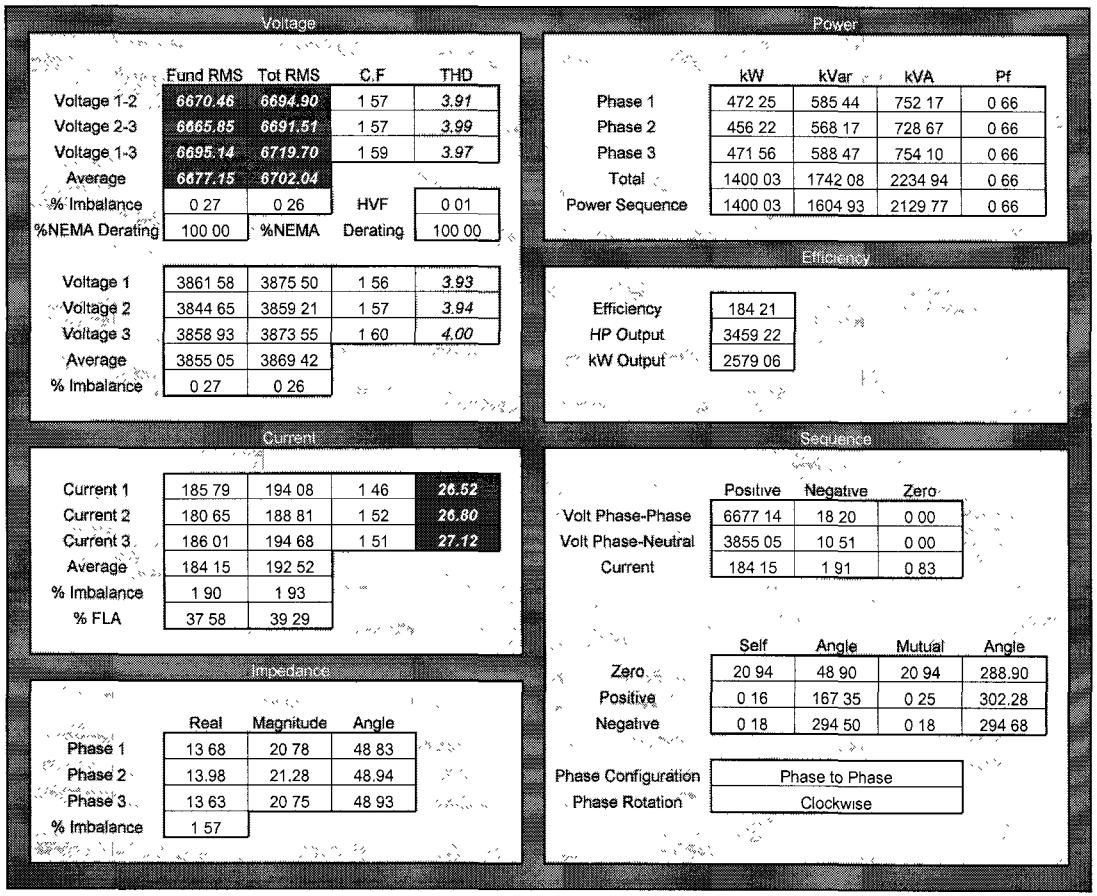

Voltage

	Fund RMS	Tot RMS	C.F	THD
Voltage 1-2	6670.46	6694.90	1 57	3.91
Voltage 2-3	6665.85	6691.51	1 57	3.99
Voltage 1-3	6695.14	6719.70	1 59	3.97
Average	6677.15	6702.04		
% Imbalance	0 27	0 26	HVF	0 01
%NEMA Derating	100 00	%NEMA	Derating	100 00

Voltage 1	3861 58	3875 50	1 56	3.93
Voltage 2	3844 65	3859 21	1 57	3.94
Voltage 3	3858 93	3873 55	1 60	4.00
Average	3855 05	3869 42		
% Imbalance	0 27	0 26		

Power

	kW	kVar	kVA	Pf
Phase 1	472 25	585 44	752 17	0 66
Phase 2	456 22	568 17	728 67	0 66
Phase 3	471 56	588 47	754 10	0 66
Total	1400 03	1742 08	2234 94	0 66
Power Sequence	1400 03	1604 93	2129 77	0 66

Efficiency

Efficiency	184 21
HP Output	3459 22
kW Output	2579 06

Current

Current 1	185 79	194 08	1 46	26.52
Current 2	180 65	188 81	1 52	26.80
Current 3	186 01	194 68	1 51	27.12
Average	184 15	192 52		
% Imbalance	1 90	1 93		
% FLA	37 58	39 29		

Impedance

	Real	Magnitude	Angle
Phase 1	13 68	20 78	48 83
Phase 2	13.98	21.28	48.94
Phase 3	13 63	20 75	48 93
% Imbalance	1 57		

Sequence

	Positive	Negative	Zero
Volt Phase-Phase	6677 14	18 20	0 00
Volt Phase-Neutral	3855 05	10 51	0 00
Current	184 15	1 91	0 83

	Self	Angle	Mutual	Angle
Zero	20 94	48 90	20 94	288.90
Positive	0 16	167 35	0 25	302.28
Negative	0 18	294 50	0 18	294 68

Phase Configuration	Phase to Phase
Phase Rotation	Clockwise

IP7_025836

UNIT 1 1B/

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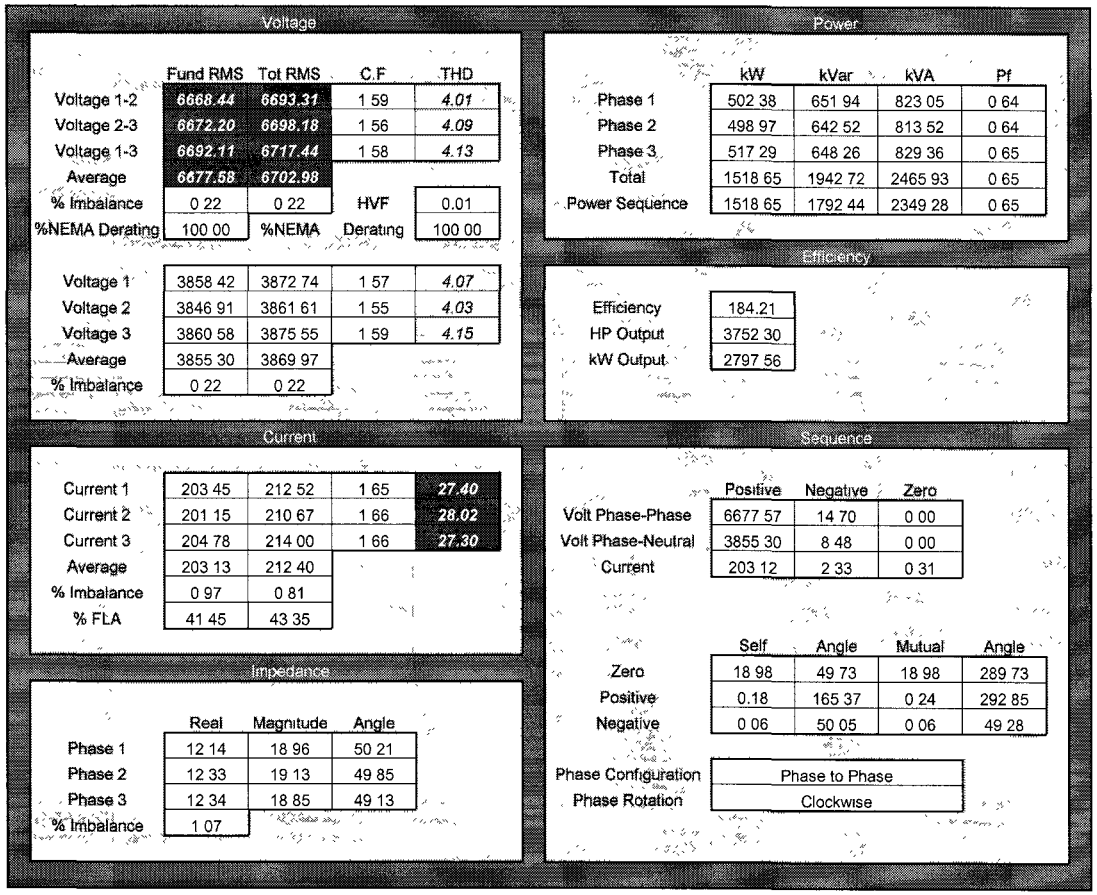

Voltage

	Fund RMS	Tot RMS	C.F	THD
Voltage 1-2	6668.44	6693.31	1 59	4.01
Voltage 2-3	6672.20	6698.18	1 56	4.09
Voltage 1-3	6692.11	6717.44	1 58	4.13
Average	6677.58	6702.98		
% Imbalance	0 22	0 22	HVF	0.01
%NEMA Derating	100 00	%NEMA	Derating	100 00

Voltage 1	3858 42	3872 74	1 57	4.07
Voltage 2	3846 91	3861 61	1 55	4.03
Voltage 3	3860 58	3875 55	1 59	4.15
Average	3855 30	3869 97		
% Imbalance	0 22	0 22		

Power

	kW	kVar	kVA	Pf
Phase 1	502 38	651 94	823 05	0 64
Phase 2	498 97	642 52	813 52	0 64
Phase 3	517 29	648 26	829 36	0 65
Total	1518 65	1942 72	2465 93	0 65
Power Sequence	1518 65	1792 44	2349 28	0 65

Efficiency

Efficiency	184.21
HP Output	3752 30
kW Output	2797 56

Current

Current 1	203 45	212 52	1 65	27.40
Current 2	201 15	210 67	1 66	28.02
Current 3	204 78	214 00	1 66	27.30
Average	203 13	212 40		
% Imbalance	0 97	0 81		
% FLA	41 45	43 35		

Impedance

	Real	Magnitude	Angle
Phase 1	12 14	18 96	50 21
Phase 2	12 33	19 13	49 85
Phase 3	12 34	18 85	49 13
% Imbalance	1 07		

Sequence

	Positive	Negative	Zero
Volt Phase-Phase	6677 57	14 70	0 00
Volt Phase-Neutral	3855 30	8 48	0 00
Current	203 12	2 33	0 31

	Self	Angle	Mutual	Angle
Zero	18 98	49 73	18 98	289 73
Positive	0.18	165 37	0 24	292 85
Negative	0 06	50 05	0 06	49 28

Phase Configuration	Phase to Phase
Phase Rotation	Clockwise

IP7_025837

UNIT 1 1B2

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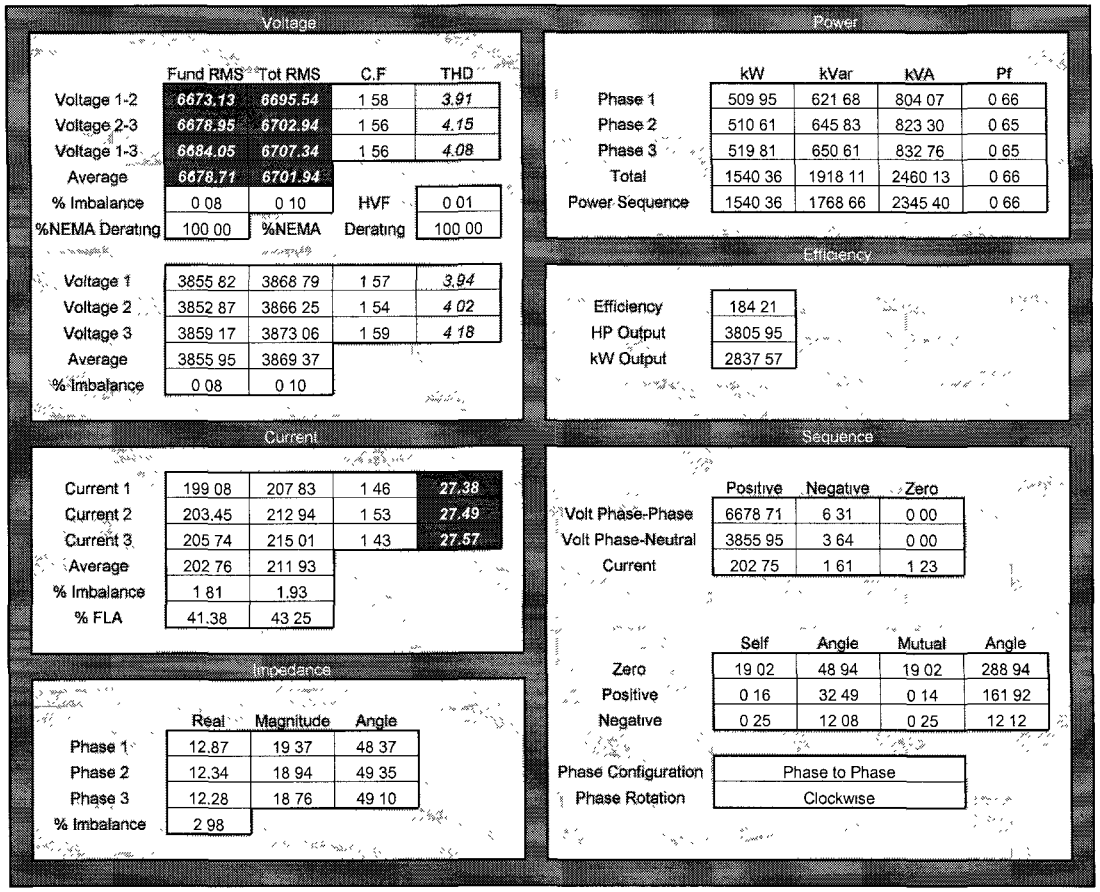

Voltage

	Fund RMS	Tot RMS	C.F	THD
Voltage 1-2	6673.13	6695.54	1 58	3.91
Voltage 2-3	6678.95	6702.94	1 56	4.15
Voltage 1-3	6684.05	6707.34	1 56	4.08
Average	6678.71	6701.94		
% Imbalance	0 08	0 10	HVF	0 01
%NEMA Derating	100 00	%NEMA	Derating	100 00

Voltage 1	3855 82	3868 79	1 57	3.94
Voltage 2	3852 87	3866 25	1 54	4 02
Voltage 3	3859 17	3873 06	1 59	4 18
Average	3855 95	3869 37		
% Imbalance	0 08	0 10		

Power

	kW	kVar	kVA	Pf
Phase 1	509 95	621 68	804 07	0 66
Phase 2	510 61	645 83	823 30	0 65
Phase 3	519 81	650 61	832 76	0 65
Total	1540 36	1918 11	2460 13	0 66
Power Sequence	1540 36	1768 66	2345 40	0 66

Efficiency

Efficiency	184 21
HP Output	3805 95
kW Output	2837 57

Current

Current 1	199 08	207 83	1 46	27.38
Current 2	203.45	212 94	1 53	27.49
Current 3	205 74	215 01	1 43	27.57
Average	202 76	211 93		
% Imbalance	1 81	1.93		
% FLA	41.38	43 25		

Sequence

	Positive	Negative	Zero
Volt Phase-Phase	6678 71	6 31	0 00
Volt Phase-Neutral	3855 95	3 64	0 00
Current	202 75	1 61	1 23

	Self	Angle	Mutual	Angle
Zero	19 02	48 94	19 02	288 94
Positive	0 16	32 49	0 14	161 92
Negative	0 25	12 08	0 25	12 12

Phase Configuration	Phase to Phase
Phase Rotation	Clockwise

Impedance

	Real	Magnitude	Angle
Phase 1	12.87	19 37	48 37
Phase 2	12.34	18 94	49 35
Phase 3	12.28	18 76	49 10
% Imbalance	2 98		

IP7_025838

UNIT 161

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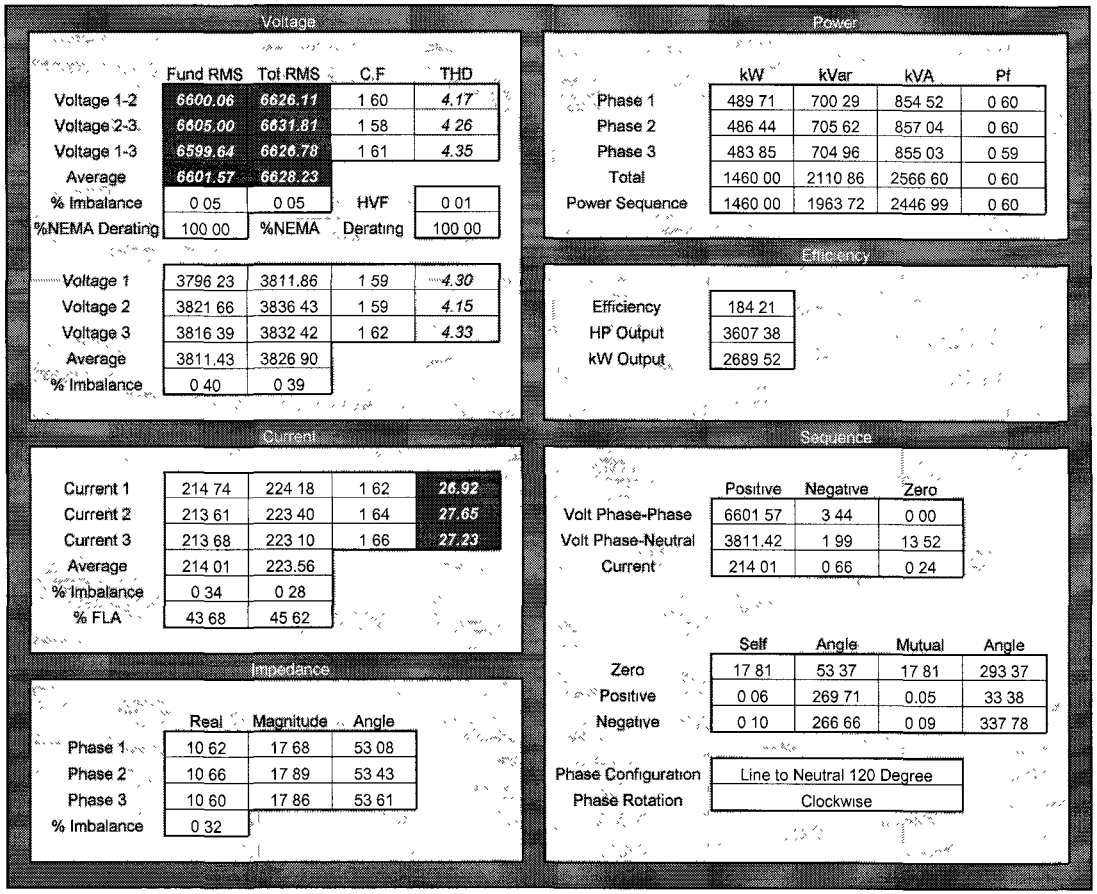

Voltage

	Fund RMS	Tot RMS	C.F	THD
Voltage 1-2	6600.06	6626.11	1 60	4.17
Voltage 2-3	6605.00	6631.81	1 58	4 26
Voltage 1-3	6599.64	6626.78	1 61	4.35
Average	6601.57	6628.23		
% Imbalance	0 05	0 05	HVF	0 01
%NEMA Derating	100 00	%NEMA	Derating	100 00

Voltage 1	3796 23	3811.86	1 59	4.30
Voltage 2	3821 66	3836 43	1 59	4.15
Voltage 3	3816 39	3832 42	1 62	4.33
Average	3811.43	3826 90		
% Imbalance	0 40	0 39		

Power

	kW	kVar	kVA	Pf
Phase 1	489 71	700 29	854 52	0 60
Phase 2	486 44	705 62	857 04	0 60
Phase 3	483 85	704 96	855 03	0 59
Total	1460 00	2110 86	2566 60	0 60
Power Sequence	1460 00	1963 72	2446 99	0 60

Efficiency

Efficiency	184 21
HP Output	3607 38
kW Output	2689 52

Current

Current 1	214 74	224 18	1 62	26.92
Current 2	213 61	223 40	1 64	27.65
Current 3	213 68	223 10	1 66	27.23
Average	214 01	223.56		
% Imbalance	0 34	0 28		
% FLA	43 68	45 62		

Impedance

	Real	Magnitude	Angle
Phase 1	10 62	17 68	53 08
Phase 2	10 66	17 89	53 43
Phase 3	10 60	17 86	53 61
% Imbalance	0 32		

Sequence

	Positive	Negative	Zero
Volt Phase-Phase	6601 57	3 44	0 00
Volt Phase-Neutral	3811.42	1 99	13 52
Current	214 01	0 66	0 24

	Self	Angle	Mutual	Angle
Zero	17 81	53 37	17 81	293 37
Positive	0 06	269 71	0.05	33 38
Negative	0 10	266 66	0 09	337 78

Phase Configuration	Line to Neutral 120 Degree
Phase Rotation	Clockwise

IP7_025839

UNIT 1 IC2

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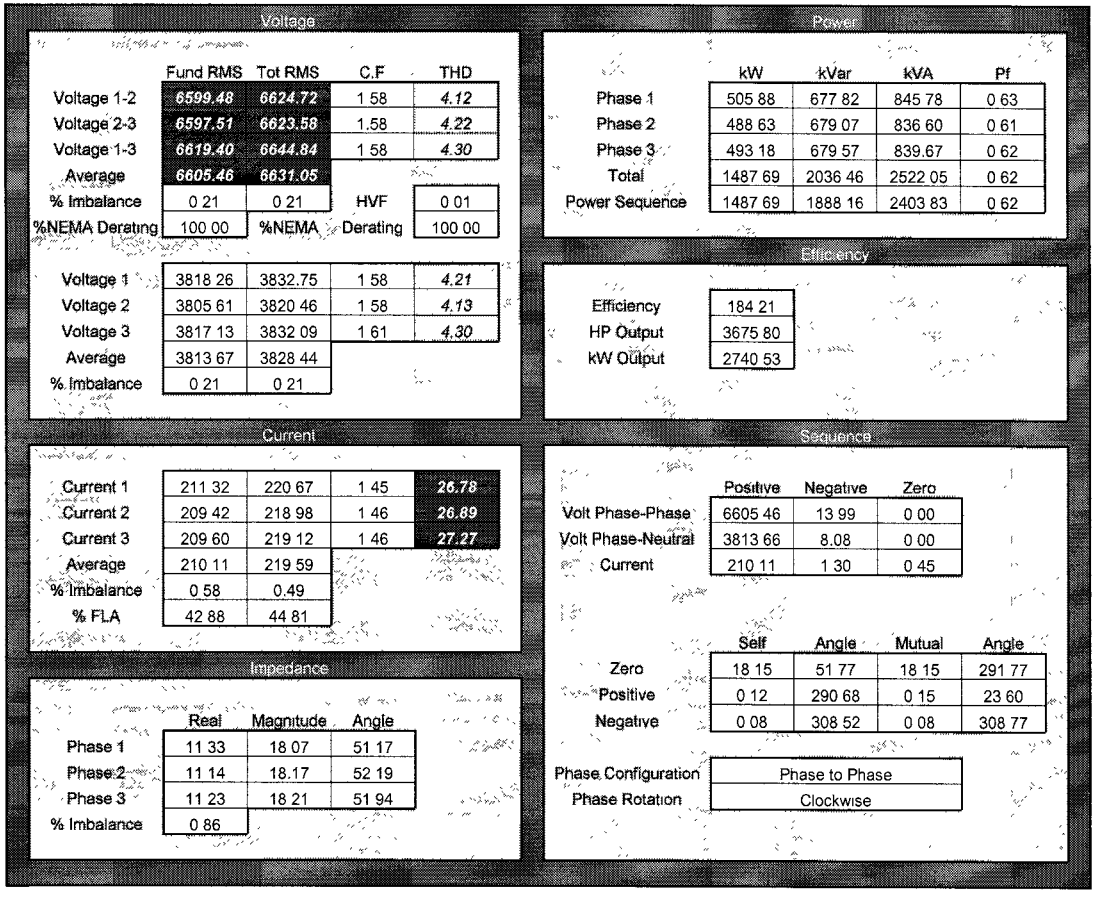


Voltage

	Fund RMS	Tot RMS	C.F	THD
Voltage 1-2	6599.48	6624.72	1 58	4.12
Voltage 2-3	6597.51	6623.58	1.58	4.22
Voltage 1-3	6619.40	6644.84	1 58	4.30
Average	6605.46	6631.05		
% Imbalance	0 21	0 21	HVF	0 01
%NEMA Derating	100 00	%NEMA	Derating	100 00

Voltage 1	3818 26	3832.75	1 58	4.21
Voltage 2	3805 61	3820 46	1 58	4.13
Voltage 3	3817 13	3832 09	1 61	4.30
Average	3813 67	3828 44		
% Imbalance	0 21	0 21		

Power

	kW	kVar	kVA	Pf
Phase 1	505 88	677 82	845 78	0 63
Phase 2	488 63	679 07	836 60	0 61
Phase 3	493 18	679 57	839.67	0 62
Total	1487 69	2036 46	2522 05	0 62
Power Sequence	1487 69	1888 16	2403 83	0 62

Efficiency

Efficiency	184 21
HP Output	3675 80
kW Output	2740 53

Current

Current 1	211 32	220 67	1 45	26.78
Current 2	209 42	218 98	1 46	26.89
Current 3	209 60	219 12	1 46	27.27
Average	210 11	219 59		
% Imbalance	0 58	0.49		
% FLA	42 88	44 81		

Sequence

	Positive	Negative	Zero
Volt Phase-Phase	6605 46	13 99	0 00
Volt Phase-Neutral	3813 66	8.08	0 00
Current	210 11	1 30	0 45

	Self	Angle	Mutual	Angle
Zero	18 15	51 77	18 15	291 77
Positive	0 12	290 68	0 15	23 60
Negative	0 08	308 52	0 08	308 77

Phase Configuration	Phase to Phase
Phase Rotation	Clockwise

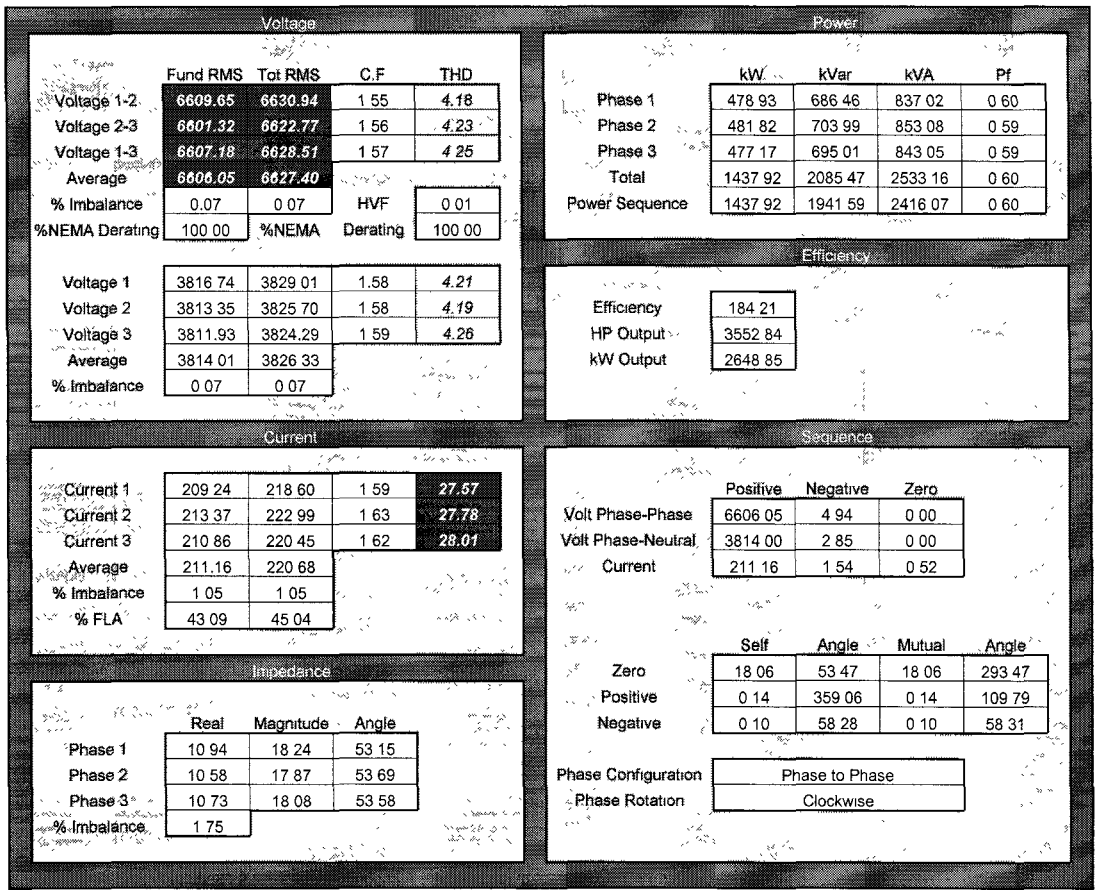
Impedance

	Real	Magnitude	Angle
Phase 1	11 33	18 07	51 17
Phase 2	11 14	18.17	52 19
Phase 3	11 23	18 21	51 94
% Imbalance	0 86		

IP7_025840

UNIT 1 1P1

1D1 Motor 08/1[illegible]2 01 06 04 PM



Voltage

	Fund RMS	Tot RMS	C.F	THD
Voltage 1-2	6609.65	6630.94	1 55	4.18
Voltage 2-3	6601.32	6622.77	1 56	4.23
Voltage 1-3	6607.18	6628.51	1 57	4.25
Average	6606.05	6627.40		
% Imbalance	0.07	0 07	HVF	0 01
%NEMA Derating	100 00	%NEMA	Derating	100 00

Voltage 1	3816 74	3829 01	1.58	4.21
Voltage 2	3813 35	3825 70	1 58	4.19
Voltage 3	3811.93	3824.29	1 59	4.26
Average	3814 01	3826 33		
% Imbalance	0 07	0 07		

Power

	kW	kVar	kVA	Pf
Phase 1	478 93	686 46	837 02	0 60
Phase 2	481 82	703 99	853 08	0 59
Phase 3	477 17	695 01	843 05	0 59
Total	1437 92	2085 47	2533 16	0 60
Power Sequence	1437 92	1941 59	2416 07	0 60

Efficiency

Efficiency	184 21
HP Output	3552 84
kW Output	2648 85

Current

Current 1	209 24	218 60	1 59	27.57
Current 2	213 37	222 99	1 63	27.78
Current 3	210 86	220 45	1 62	28.01
Average	211.16	220 68		
% Imbalance	1 05	1 05		
% FLA	43 09	45 04		

Impedance

	Real	Magnitude	Angle
Phase 1	10 94	18 24	53 15
Phase 2	10 58	17 87	53 69
Phase 3	10 73	18 08	53 58
% Imbalance	1 75		

Sequence

	Positive	Negative	Zero
Volt Phase-Phase	6606 05	4 94	0 00
Volt Phase-Neutral	3814 00	2 85	0 00
Current	211 16	1 54	0 52

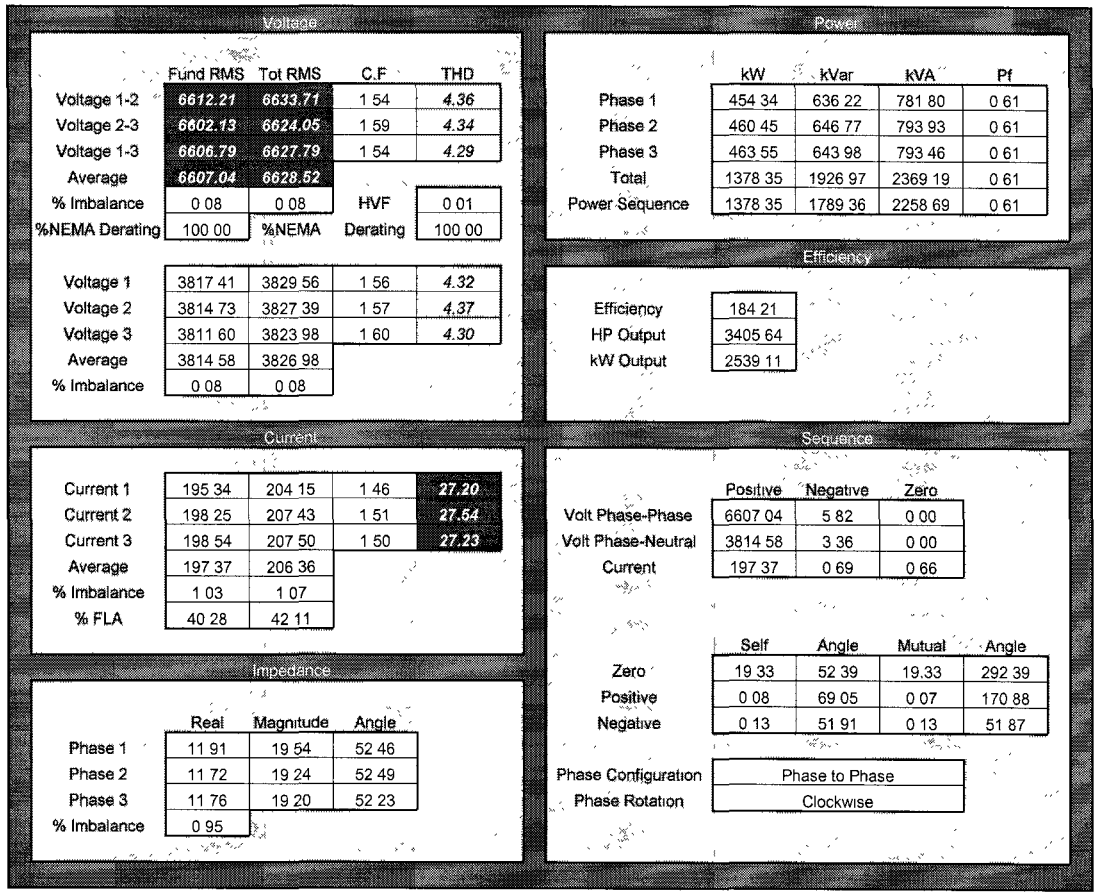
	Self	Angle	Mutual	Angle
Zero	18 06	53 47	18 06	293 47
Positive	0 14	359 06	0 14	109 79
Negative	0 10	58 28	0 10	58 31

Phase Configuration	Phase to Phase
Phase Rotation	Clockwise

IP7_025841

UNIT 1 1D2E

1D2 Motor 08/1[illegible]2 01:08:24 PM



Voltage

	Fund RMS	Tot RMS	C.F	THD
Voltage 1-2	6612.21	6633.71	1 54	4.36
Voltage 2-3	6602.13	6624.05	1 59	4.34
Voltage 1-3	6606.79	6627.79	1 54	4.29
Average	6607.04	6628.52		
% Imbalance	0 08	0 08	HVF	0 01
%NEMA Derating	100 00	%NEMA	Derating	100 00

Voltage 1	3817 41	3829 56	1 56	4.32
Voltage 2	3814 73	3827 39	1 57	4.37
Voltage 3	3811 60	3823 98	1 60	4.30
Average	3814 58	3826 98		
% Imbalance	0 08	0 08		

Power

	kW	kVar	kVA	Pf
Phase 1	454 34	636 22	781 80	0 61
Phase 2	460 45	646 77	793 93	0 61
Phase 3	463 55	643 98	793 46	0 61
Total	1378 35	1926 97	2369 19	0 61
Power Sequence	1378 35	1789 36	2258 69	0 61

Efficiency

Efficiency	184 21
HP Output	3405 64
kW Output	2539 11

Current

Current 1	195 34	204 15	1 46	27.20
Current 2	198 25	207 43	1 51	27.54
Current 3	198 54	207 50	1 50	27.23
Average	197 37	206 36		
% Imbalance	1 03	1 07		
% FLA	40 28	42 11		

Impedance

	Real	Magnitude	Angle
Phase 1	11 91	19 54	52 46
Phase 2	11 72	19 24	52 49
Phase 3	11 76	19 20	52 23
% Imbalance	0 95		

Sequence

	Positive	Negative	Zero
Volt Phase-Phase	6607 04	5 82	0 00
Volt Phase-Neutral	3814 58	3 36	0 00
Current	197 37	0 69	0 66

	Self	Angle	Mutual	Angle
Zero	19 33	52 39	19.33	292 39
Positive	0 08	69 05	0 07	170 88
Negative	0 13	51 91	0 13	51 87

Phase Configuration	Phase to Phase
Phase Rotation	Clockwise

IP7_025842